MACHINERY

Design—Construction—Operation

Volume 41 JULY, 1935 Number 11

The allowable loads on worm-gears may be limited by the beam strength of the teeth, the surface endurance limits of material, or by the heat generated in operation. Designers will find in August MACHINERY an article accompanied by a series of five charts that greatly simplify the calculation of safe worm-gear loads. These charts apply to a wide range of tooth numbers and pitch-line velocities.

Perhaps you are more directly interested in "Blanking and Drawing Thin Stock," "High-speed Riveting Fixtures," or possibly in the article featuring "Some Machine Tools of the Past." Every issue of MACHINERY teems with variety, interest, practical value.

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DEPARTMENTS

PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York
ROBERT B. LUCHARS.....*President*
EDGAR A. BECKER..*Vice-pres. and Treasurer*
ERIK OBERG .....*Editor*
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LONDON: 52-54 High Holborn
PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents.
Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue.
Send old as well as new address.

Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879.
Printed in the United States of America.

The World Turns Best
on Lodge & Shipley Lathes

MACHINERY

Volume 41 NEW YORK, JULY, 1935 Number 11

Tube Bending on a Production Basis

By CHARLES O. HERB

PLEASING appearance and riding comfort have of late been the chief aims of the automobile designer. The body and its equipment to the smallest detail, both inside and outside, must be attractive in appearance and at the same time, afford operating convenience and riding ease. In Chrysler and DeSoto "Airflow" automobiles, the appearance of the car interior has been considerably enhanced by constructing the frame of the front seat from chromium-plated seamless steel tubing. The parts shown in Fig. 1 are used in making seat frames, the angle-iron supports and the brackets at the bottom of the illustration being invisible in the finished seat.

The seamless steel tubing used in making these seat frames has an outside diameter of 1 inch and an inside diameter of 7/8 inch. The tubing is received from the mill in 20-foot lengths and is cut up by a circular saw to suitable lengths. The saw is arranged with stops that enable the required lengths to be easily cut from the long tubes.

Hydraulic Machines Shape Seamless Steel Tubing into Seat Frames of Attractive Design for Chrysler Cars

★

From the saw, the tubes are passed to two batteries of polishing machines, one of which is shown in Fig. 2. Each battery consists of three machines. The tubes are run through the first battery twice for rough polishing, and through the second battery once for obtaining a high mirror-like finish. Emery powder from 90 to about 240 grit is used on the successive wheels. Both batteries of polishing machines were built by the Production Machine Co., Greenfield, Mass.

Tube *A* in Fig. 1 extends around the back of sedan seats, as shown in the heading illustration. It serves both as a grip rail and as a support for the seat. This tube is bent to shape in the hydraulically actuated machine shown in Fig. 3, which was built by Williams, White & Co., Moline, Ill., as were also the other bending machines described in this article.

Fig. 1. Chromium-plated Seamless Steel Tubes are Used on "Airflow" Automobiles to Produce Seat Frames of an Attractive Appearance

At the beginning of an operation, the swinging units *A* and *B* are positioned at the back of the machine parallel with the clamping units *C* and *D*. Also, the swinging anvil *E* is positioned with its semicircular groove toward the back and right-hand end of the machine. The straight tube is placed lengthwise between units *A*, *B*, *C*, and *D* and the swinging anvil *E*, the stationary bending anvil *F*, and block *G*. The anvils of units *A*, *B*, *C*, and *D* are then advanced hydraulically to grip the work by operating a control valve at the front of the table to admit oil under pressure into the cylinders of the various units. When the clamping has been accomplished, a second valve at the front of the machine is operated to swing units *A* and *B* 90 degrees toward the front of the machine. During this movement, the ends of the tube are bent around anvils *E* and *F*. Both bends are made at a radius of 5 inches.

With the ends of the tube now extending toward the front of the machine, they can be gripped by clamps on units *H*, *J*, *K*, and *L*, the latter two units being positioned immediately adjacent to units *H* and *J* instead of as shown in the illustration. Then units *K* and *L* are hydraulically advanced toward the front of the table on angular ways to bend the

Fig. 2. A High Mirror-like Polish is Imparted to the Seamless Steel Tubes before They Reach the Bending Machines

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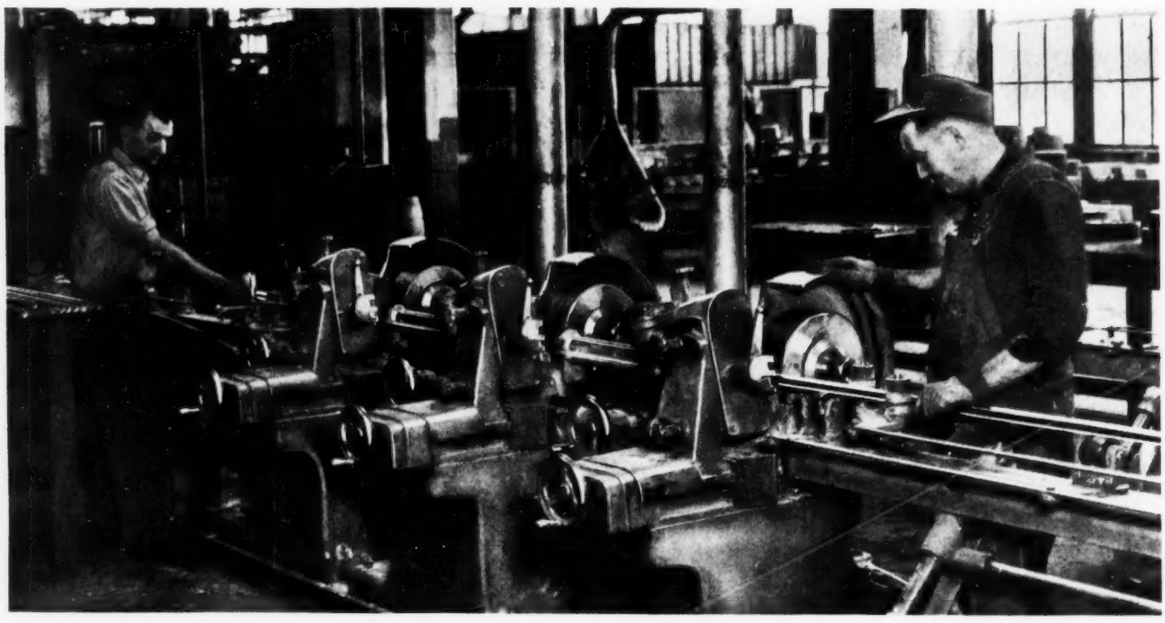

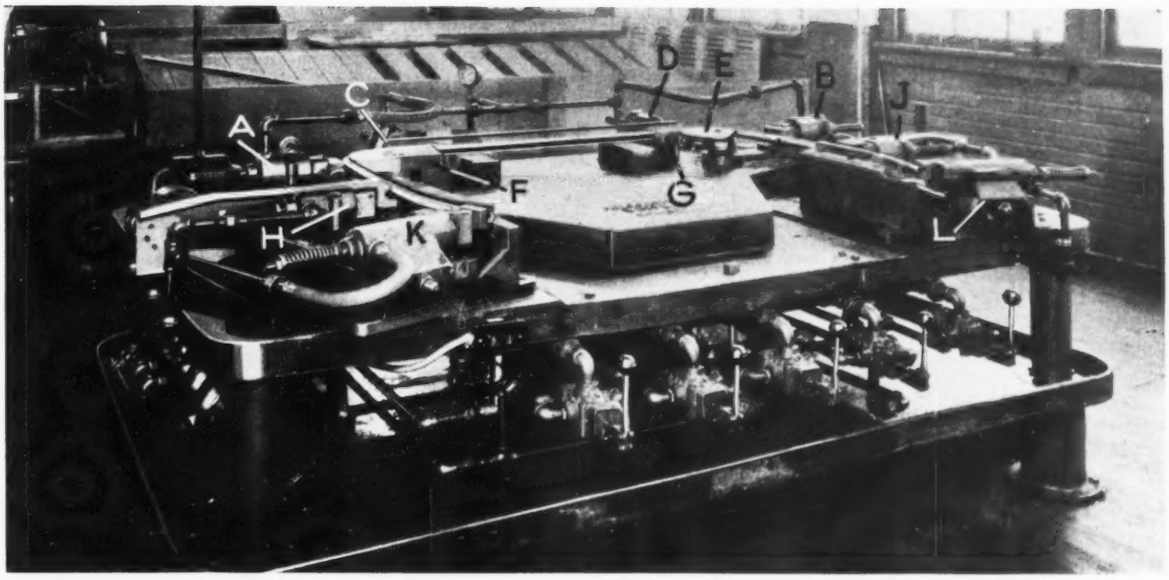

Fig. 3 Hydraulically Operated Machine that Makes Four Bends in the Tubes that Extend around the Back of Sedan Seats

★

ends of the tube to the desired curvature. Anvil *E* was made movable to enable the bent tube to be removed from the machine.

After these sedan seat frames have been produced as described, the section that runs along the top of the seat is kinked slightly, adjacent to the 90-degree bends. This operation is performed with the equipment shown in Fig. 4. After the tube has been placed on anvils *A* and *B*, a valve is operated which brings jaws *C* and *D* downward, clamping the tube securely to the anvils. Then a second valve is operated to actuate the piston in

Fig. 4. Making Two Slight Bends at the Top of the Long Tube that Extends around the Back of Sedan Seats

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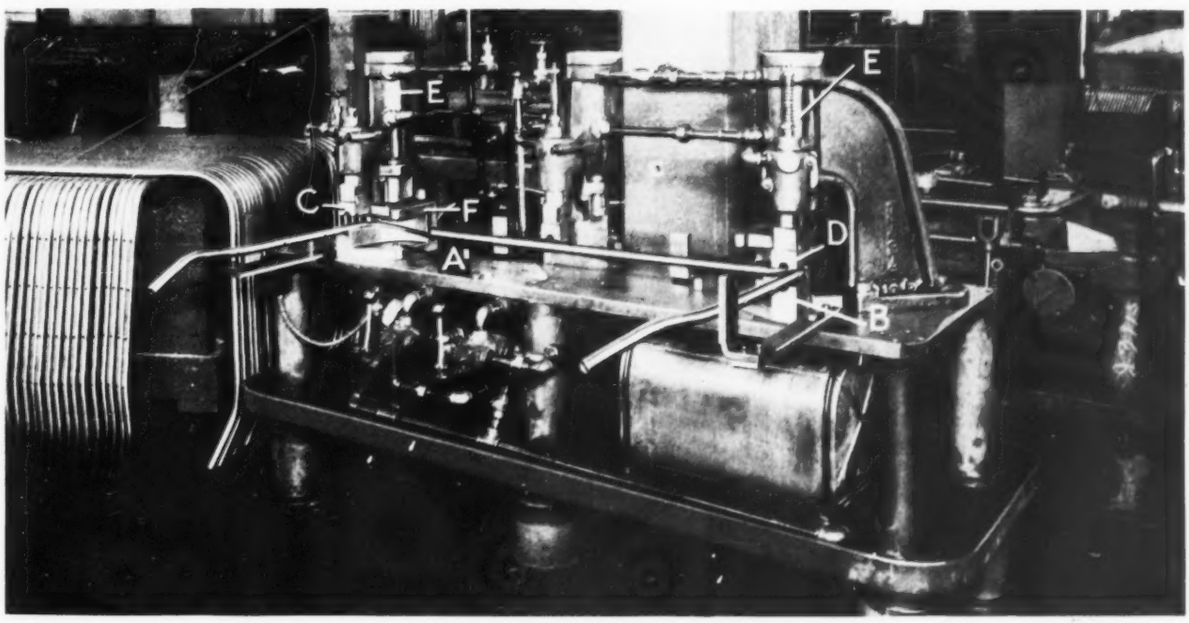

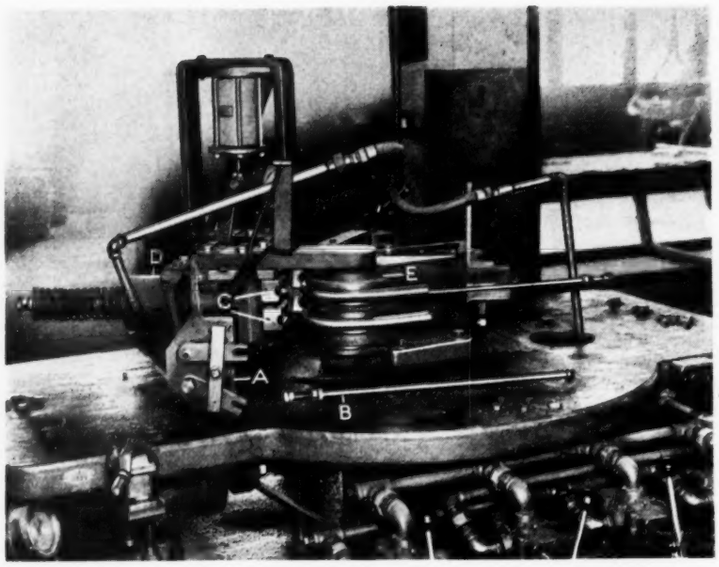

Fig. 5. The Spherical End of a Long Rod B is Used to Support the Inside Wall of the Tubes in Bending to Radii of Less than 5 Inches

each cylinder *E*, so as to force anvils *F* on the work under sufficient pressure to effect the bending. The unit at the center of the table was originally supplied for another operation that was recently discontinued.

The Tubes are Supported Internally in Bending to Small Radii

When the tubes are bent to a radius of less than 5 inches, they must be supported on the inside to prevent crinkling of the wall. Such a provision insures success in bending the front-seat side arms shown at *B* in Fig. 1, which are bent at one point to a radius of 4 inches. This operation is performed with the machine shown in Fig. 5, which is equipped for bending two arms at a time.

The illustration shows the various moving members of the machine withdrawn from the work to permit reloading. When the straight tubes are placed in the fixture at the beginning of the operation, they extend forward at an angle toward bracket *A*. They are securely gripped for the operation by clamps actuated through the vertical air cylinder at the rear left of the machine. Then a long rod (seen on the table at *B*) is inserted in each tube and the opposite end of the rod placed in a slot in the finger attached to bracket *A*.

Fig. 6. Machine Used in Bending Coach Seat Frames to a Rectangular Outline in Two Operations

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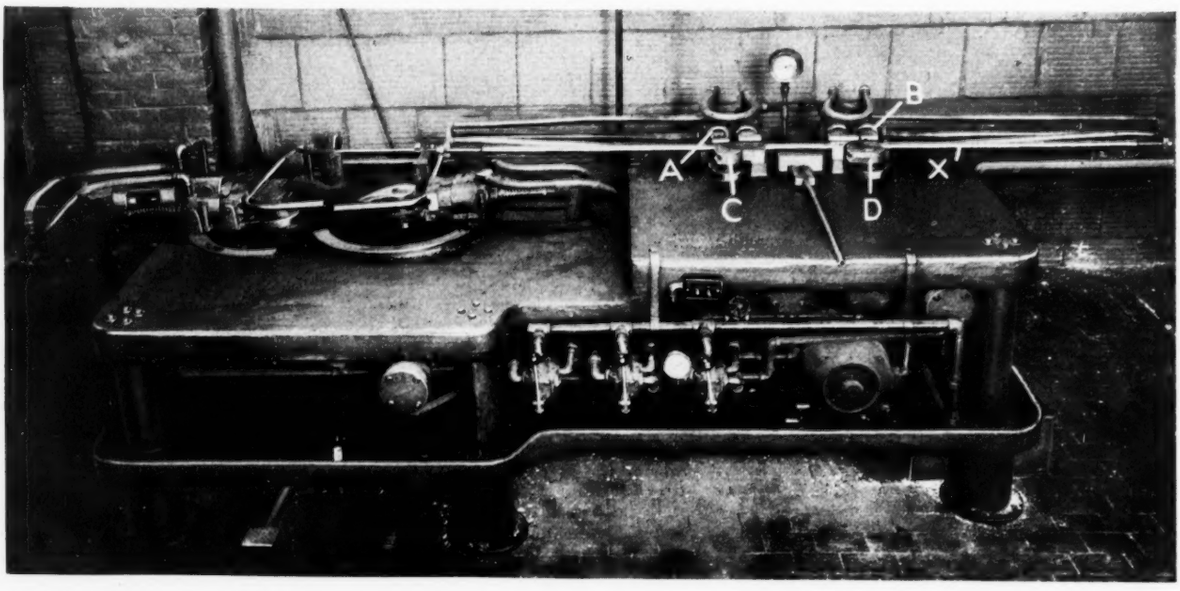


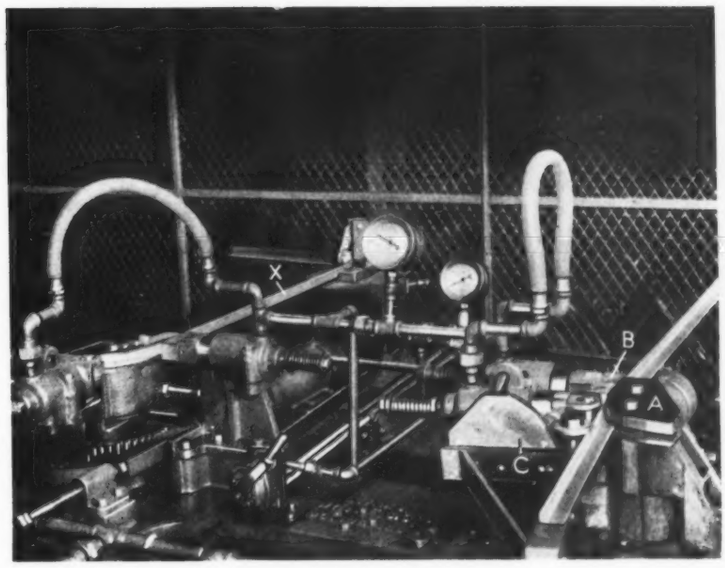


Fig. 7. Duplex Machine Employed for Making Two Right-angle Bends in the Angle-irons that are Used to Support the Seat Cushion

Rod *B* is of such a length that the ball on the end inside the tube is directly on the other side of the tube wall from the corresponding anvil *C*. The ball end is of approximately the same diameter as the inside of the tube. With this arrangement, the ball end offers a firm support for the tube wall when unit *D* is swung around anvil *E* to shape the tube. Unit *D* is actuated hydraulically—both the forward movement of its jaws and the swinging movement of the entire unit.

Rectangular Tube-Frames Support the Back of Coach Seats

Coach seat frames are made with a back of the shape seen at *C* and *D* in Fig. 1. These tubes are bent in two operations performed in the machine shown in Fig. 6. The straight piece is placed, as shown at *X*, between the four units at the back of the machine on the right-hand end. It is securely clamped when a valve is operated which advances the jaws of these units, so as to hold the tube against stationary anvils. Then a second valve is operated to swing units *A* and *B* 90 degrees toward the front of the machine, thus forming two right-angle legs. Grooved anvil *C* is stationary, but anvil *D* is pivoted to enable the bent tube to be removed. In this operation, the tube is bent to a center-line radius of 3 inches, and ball-end rods are employed to provide adequate tube wall support in the same manner as in the operation previously described.

When the first two bends have been made, the tube is transferred to the fixture at the left-hand end of the machine for completing the rectangular outline. Again, the tube is securely gripped on each end by the hydraulically actuated jaws of stationary units, and is shaped by moving units that are swung 90 degrees toward the front of the table. Ball supports are not required on the inside of the tubes in this operation. The now adjacent ends of the tube are later welded together to form a continuous frame.

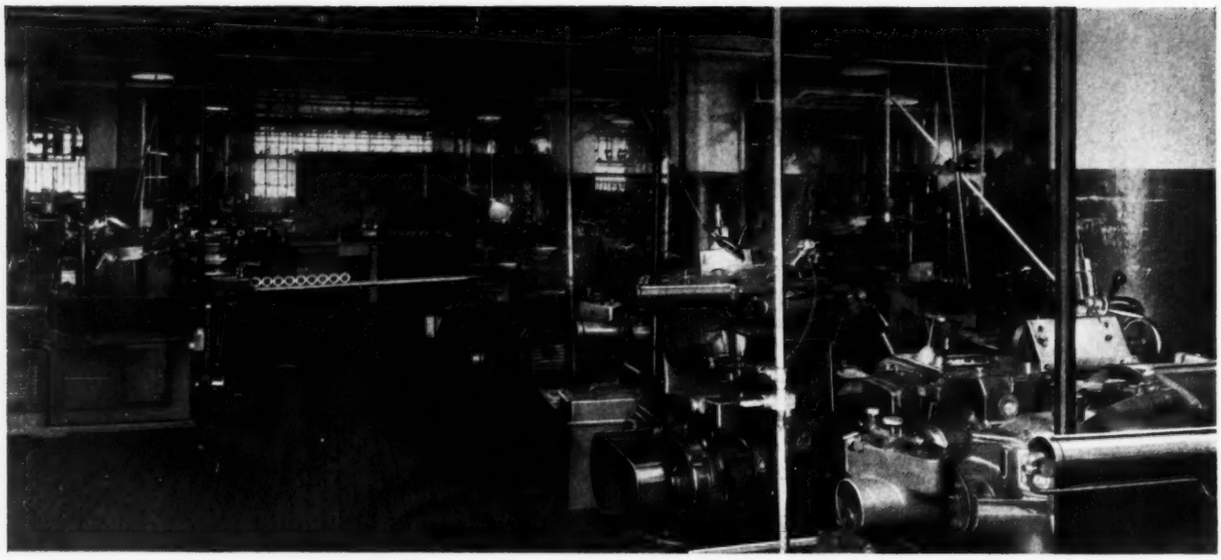
The angle-iron seat-cushion support shown at *E* in Fig. 1 is shaped in the duplex machine illustrated in Fig. 7. One end of the angle-iron is bent in the fixture on the right-hand side of the machine, and then the piece is transferred to the position shown at *X* for bending the opposite end. In each operation, 1-inch angle-iron is bent to a flange radius of about 2 1/2 inches. The angle-iron is held securely between anvil *A* and a hydraulically operated clamp *B*, and then unit *C* is swung horizontally through 90 degrees to shape the angle-iron around anvil *A*. In the second operation, the previously bent end of the angle-iron is clamped by an air-operated device at the rear, in addition to a hydraulic clamping unit at the front.

The angle-irons are slightly crinkled at the bends when they come from this machine. This crinkling is flattened out by means of a power press which, at the same time, bends the vertical leg of the angle-iron so that it forms an included angle of about 83 degrees with the horizontal leg.

In the various bending operations described, the hydraulic pressure averages 400 pounds per square inch. The tubes are "touched up" by hand-operated polishing machines along the bends before being chromium-plated.

* * *

Depletion of capital, commonly called "depreciation," is the result of three major causes: (1) *Obsolescence*—the loss of value or usefulness through the invention of new types of equipment which will make products so much more rapidly than the older equipment that a manufacturer cannot profitably use the old in competition with users of the new; (2) *service*—the physical deterioration of equipment caused by its wearing out in service and being weakened by accidents; and, (3) *inutility*—the loss of value caused by changes in style or in the public's demand for the goods made.—*Robert Scudder Denham*



Grinding Armature Shafts for Fractional-Horsepower Motors

Both Centerless Grinders and Grinders with Work-Holding Centers are Used to Advantage in Obtaining the High Degree of Accuracy and Finish Required on Motor Shafts

By A. D. MEALS
Cincinnati Grinders Incorporated, Cincinnati, Ohio

THE finishing of armature shafts for fractional-horsepower motors used in washing machines, electric refrigerators, and similar products demands methods that give a high degree of precision, as well as a high production rate. The customers for motors in this field are not satisfied with motors that are merely quiet, but are demanding motors that operate silently. Hence the necessity for a high degree of accuracy and a high finish on the bearings of the armature shaft, which is the heart of the motor. The rotor mounted on the armature shaft must also be finished accurately to the required diameter. It must be straight and concentric with the bearings of the armature shaft to insure a uniform air gap between the rotor and the field of the motor frame.

An ideal installation of grinding machines for these shafts sometimes includes both centerless grinders and center type grinders, and sometimes centerless grinders only, depending upon the motor manufacturer's requirements. Centerless grinders are meeting the requirements in plants demanding high production. In plants where a large variety of sizes and types of armature shafts are ground in small lots, center type grinders alone give the most satisfactory results. Also, on the grinding of larger size armature shafts, the center type grinder is used almost exclusively.

The most efficient method of grinding armature shafts depends on the number of different diameters specified and the size of the shaft, together with the size of the lots ground and the limits of accuracy required. As an example, the armature shaft shown in Fig. 1 is manufactured on a production basis of 100 complete shafts an hour, grinding not only the outside diameter of the rotor mounted on the shaft, concentric with the shaft bearings, but also the shaft itself.

The requirements for the shaft are that the various diameters must be absolutely concentric with each other, and the two 1/2-inch bearing diameters must be ground to a high finish and must be straight within 0.0001 inch, to size within 0.0003 inch, and round to a zero reading on a liquid gage. These requirements are being satisfactorily met with an installation of grinders consisting of the three Cincinnati centerless grinders and the three 6- by 18-inch saddle type grinders shown in the heading illustration.

The first operation on the shaft shown in Fig. 1 consists of finish-grinding section *C* and rough-grinding section *D*, as shown in the lower view. The production data on this and the five succeeding operations are given in the accompanying table. The in-feed method is used with the faces of both grinding and regulating wheels of the centerless

Data on Grinding Operations Performed on Armature Shafts

Oper. No.	Grind		Stock Removal on Diameter	No. Cuts	Limits			Net Production, Pieces per Hour	Type of Grinder
	Diameter	Length			Round	Straight	Size		
1	0.630	4 1/2	0.010 to 0.012	1	0.0005	0.0005	0.0005	120	No. 2 Centerless
	1/2	3 1/4							
2	1/2	1 5/8	0.012 to 0.015	1	0.0005	0.0005	0.001	240	No. 2 Centerless
3	3 1/2	2	0.040 to 0.045	1	0.001	0.001	0.003	100 to 120	No. 2 Centerless
	Rotor								
4	5/8	1	0.004 to 0.005	1	0.0005	0.0005	0.0005	120	6- by 18-inch Saddle Type
5	1/2	1 5/8	0.002 to 0.003	1	0.0000	0.0001	0.0003	120	6- by 18-inch Saddle Type
6	1/2	3 1/4	0.002 to 0.003	1	0.0000	0.0001	0.0003	120	6- by 18-inch Saddle Type

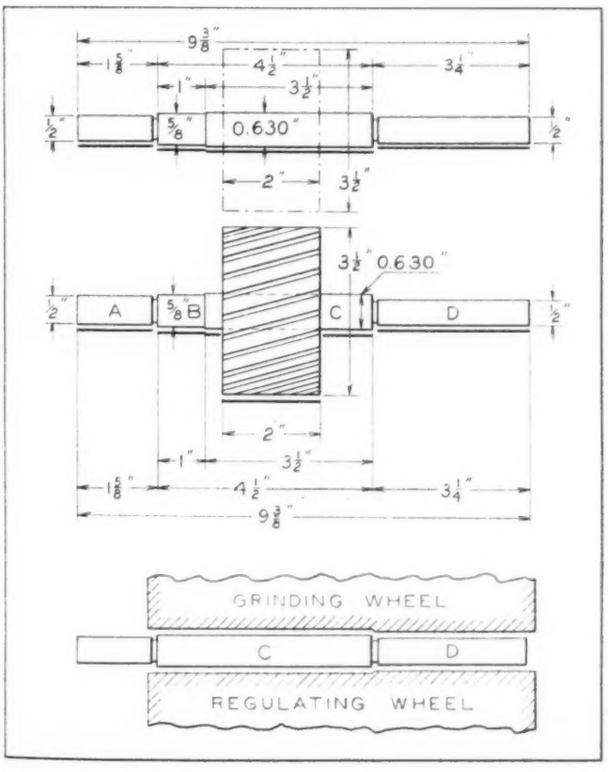
grinder stepped properly to grind the two sections to the specified diameters simultaneously. The work-support plate must also be stepped to obtain a suitable bearing on the two sections. Profile attachments with master cams are used to dress both wheel faces to the correct step dimensions. The work is automatically ejected from the grinding position after the grinding cut has been completed.

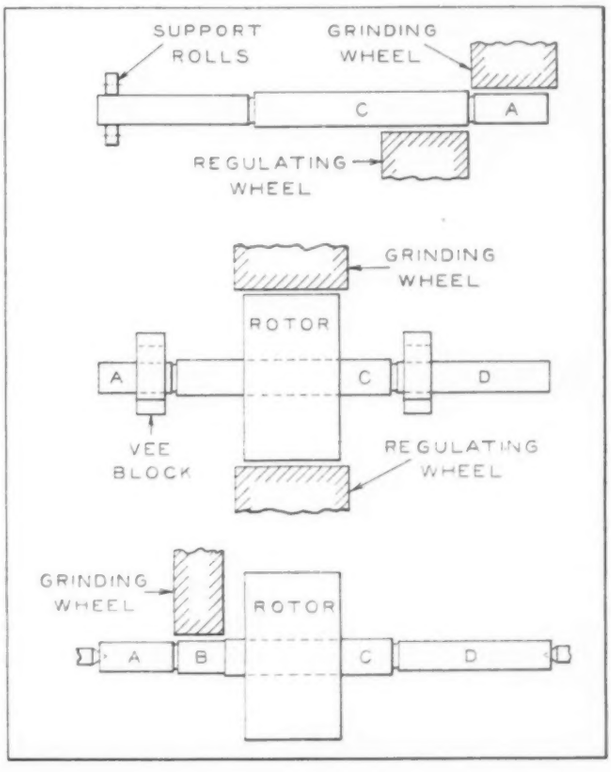
The second operation consists of rough-grinding section *A* as indicated in the top view of Fig. 2. In order to establish concentricity between the diameter to be ground and the other diameters on the shaft, an offset regulating wheel is used. An in-feed cut is taken on section *A* with the regulating wheel bearing on the previously ground section *C*. The outboard end of the shaft is supported on adjustable rolls which are a part of the in-feed work-rest. At this point in the sequence of operations, the shaft is centered and the rotor is then pressed on it.

In the third operation, the rotor is ground concentric with the bearings of the shaft, as indicated in the central view of Fig. 2. The bearings at *A* and *D* on the shaft are located in V-blocks with the open side of the vee toward the regulating wheel. A mechanical elevating and lowering attachment loads the shaft into the grinding position by locating the bearing diameters on one of the horizontally extended sides of the V-block, which acts as a shelf. As the wheels are moved together to start the in-feed cut, the face of the regulating wheel comes in contact with the rotor and moves

Fig. 1. (Upper) Armature Shaft for Fractional-horsepower Motor; (Center) Rotor and Shaft Assembly, with Ground Surfaces Indicated by Heavy Lines; (Lower) Two Sections of Armature Shaft Ground Simultaneously on Centerless Grinder in First Operation

Fig. 2. Diagrams Indicating the Methods of Performing the Second, Third, and Fourth Grinding Operations on the Armature Shaft and Rotor Shown in Fig. 1. The Production Data for the Various Operations are Given in the Accompanying Table





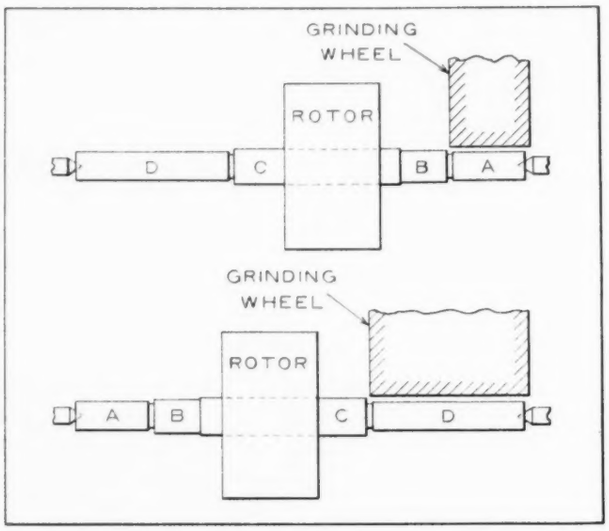


Fig. 3. Diagrams Indicating Fifth and Sixth Grinding Operations, which Complete the Rotor and Shaft Assembly of a Fractional-horsepower Electric Motor

the bearing diameters on the shaft into the throats of the V-blocks. The rotor is then moved into the face of the grinding wheel by a continued forward movement of the regulating wheel. This action is accomplished by a backlash attachment on the upper and lower machine slides.

The upper slide, carrying the regulating wheel, moves in toward the grinding wheel until the face of the regulating wheel touches the rotor and moves it a certain distance forward. The bearing diameters on the shaft are thus located in the throats of the V-blocks. At this point, the backlash attachment on the upper slide picks up the lower slide carrying the work-rest block containing the V-blocks, and with the regulating wheel face in contact with the rotor, both slides move forward as a unit until the rotor comes in contact with the grinding wheel face. Thus, the outside diameter of the rotor is ground concentric with the bearing diameters on the shaft. Owing to the out-of-round condition of the rotor in the rough, it is necessary to use a resilient or floating regulating wheel, so that contact between the rotor and regulating wheel face is maintained as the rotor rotates during the grinding cut.

In the fourth operation, section *B*, shown in the lower view of Fig. 2, is ground by taking a plunge cut. The armature shaft containing the rotor is mounted on centers in a center type grinder. Concentricity with the bearings is assured by the previously centered ends of the shaft.

The fifth operation consists of grinding the bearing *A* indicated in the upper view, Fig. 3. A plunge cut is taken with the armature shaft mounted between centers. The face of the grinding wheel is trued slowly, in order to obtain a high finish on the work.

The sixth and final operation consists of finish-grinding the bearing *D*, indicated in the lower view, Fig. 3. A center type grinder is used for this operation, with the armature shaft mounted between centers. A plunge cut is taken with the grinding wheel face, which has been dressed slowly to obtain a high finish on the work.

* * *

Gummed Tape Applied to Micrometer Barrel Serves as Tolerance Guide

By WILLIAM R. HOWELL

Having occasion to "mike" several thousand pieces of steel to determine if they were within the specified tolerance, the writer devised a tolerance guide for the micrometer which saved both time and strain on the eyes. The arrangement proved so effective and simple to apply that it is believed that others may find it useful. Two pieces of gummed tape about a quarter of an inch wide and long enough to reach a little more than half way round the graduated thimble or barrel of the micrometer were procured.

One piece of tape was stuck on the left-hand side of the barrel with the edge on the division line representing the maximum allowable size and the rest of the piece covering the graduated portion above this line. The same procedure was repeated with the second piece of tape, except that it was placed to the right with the edge starting at the graduation representing the minimum allowable size. Any reading on the exposed part of the barrel indicates a satisfactory piece. The two pieces of tape overlap at the back of the micrometer barrel and can be easily removed when the job is finished.

This kink is applicable only when none of the parts vary in size to such an extent that a complete turn of the micrometer barrel is necessary. However, when the work is finished by grinding, this seldom occurs, as the pieces are generally only a few thousandths inch larger or smaller than the required dimension. If work of this type is encountered frequently, two slip-rings or semi-circular bands of spring steel can be employed in place of the gummed tape.

* * *

Savings through the Use of Welded Piping

The fact that a welded piping system reduces maintenance costs has been stressed time and again as an argument favoring the use of welded piping installations. It is estimated that the United States Government saves approximately $10,000 annually in the maintenance cost of one of the new federal buildings, because the piping is welded instead of connected with couplings. The new building contains 25 1/2 miles of welded piping in the heating system alone. Approximately 71,800 welds were required.

The Scarcity of Machinists and Toolmakers Ahead

By C. B. COLE, President
Tool Equipment Sales Co., Chicago, Ill.

I EXPECT that in the very near future many metal-working plants will hang out a sign saying: "Help Wanted: Machinists and Toolmakers," and I expect that the response to this appeal is going to be disappointing. There may be applicants, but they will not be the skilled men that are needed.

The metal-working industry as a whole has not taken proper precautions to insure an adequate source of supply of highly skilled labor. Few plants maintained an apprentice system when business was normal, and many that did have permitted them to lapse during the last few years. Where there is any training at all going on, the tendency is to teach operators on a single line of machines, producing at best very poor machinists.

Because of the few apprentice systems being maintained; the lack of inducements for young men to become trained as skilled machinists; and the restrictions in immigration, a shortage of skilled machinists and toolmakers is apparent right now in several machinery centers.

The metal-working industry will soon find itself faced with an increase in the cost of tools, due to the scarcity of toolmakers. What it would have cost to train apprentices is likely to have to be paid out in other directions.

Since it takes considerable time to train men to become skilled machinists and toolmakers, it is none too soon for the metal-working industries to begin seriously to consider this important problem. Even the training of operators for individual machines takes time, but it can be done in a comparatively brief period by intensive training and close supervision. Right now there is a scarcity of good grinding machine operators on tool-room work in several machinery centers, and there is a need for organized training methods.

Many of our former toolmakers and other skilled men have left the industry for good because of the difficulties encountered during the past years and the meagre earnings available. Some incentive must be created to induce young men to learn a skilled trade. There ought to be a greater differentiation in the earnings of skilled and unskilled men.

It seems to the writer that there are a number of things that should be carefully considered by the industry in order to secure a new crop of toolmakers and other skilled mechanics. First, there must be adequate inducement to our young men in order to attract the right type; second, there must be effective and intelligent apprentice systems to assure a young man that he will be given an opportunity to learn the trade under competent instructors; third, there should be fairly high educational requirements for applicants who are to be trained as toolmakers, such as graduation from high school or, still better, from a vocational training school; and fourth, there should be a universally accepted standard of apprentice training adopted by the machine shop groups that would insure uniformity of training. In the small industrial centers, a system of exchange of apprentices could be worked out that would give the students an all-around training.

A national system of apprentice training would be of great advantage to the metal-working industry, as well as to the young man learning the trade. Apprentice training courses should be supervised by some local group in the community, and certain standards should be maintained. The high standard of living that our present industrial progress makes possible can only be maintained if there is an adequate number of highly skilled and trained men for industrial work. We depend on machines for maintaining our standard of living, and we depend on skilled men to build and keep these machines in operation. Hence, the cornerstone of the high standard of living in this country is a carefully worked out system of apprentice training.

Who is going to take the initiative in this most important of all industrial problems? The Government? Industry? The Trade Unions? The Technical Societies? Possibly all of these agencies combined could accomplish something that is everybody's business, but about which nobody is doing anything at present.

* * *

"Think of the engineering skill that has gone into the production of battleships, torpedoes, bombers, big Berthas, poison gas, and gas masks," says Professor Charles St. John Chubb in the *Engineering Experiment Station News* of the Ohio State University; and apparently still more engineering skill is to go into it. Mankind, taken as a unit, does not yet rate very highly on the scale of common sense.

Mounting Tapered Roller Bearings to Suit Operating Conditions

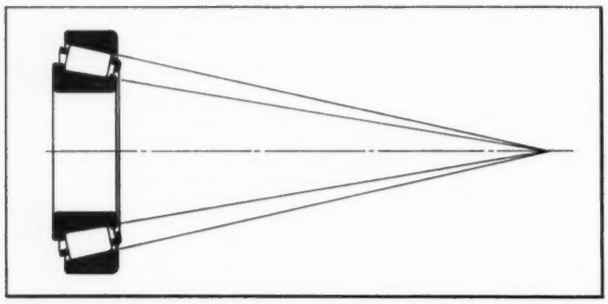


Fig. 1. Diagram Illustrating Basic Principle of Tapered Roller Bearing Design

Application of Tapered Roller Bearings with Examples of Installations Covering a Wide Range of Service

By PAUL HAAGER, Engineering Department
The Timken Roller Bearing Co.
Canton, Ohio

THE bearing loads encountered in mechanical designs are seldom entirely of one type. They may be chiefly radial, or largely thrust, but almost invariably they are a combination of both of these types acting simultaneously. Consequently, the designer has three choices—namely, to disregard one kind of loading; to use two separate bearings—one to carry the radial and the other the thrust load; or to use a bearing designed to carry combined loads, such as the Timken roller bearings shown in the accompanying illustrations. The fundamental principle incorporated in the design of this type of bearing will become evident on analyzing Fig. 1.

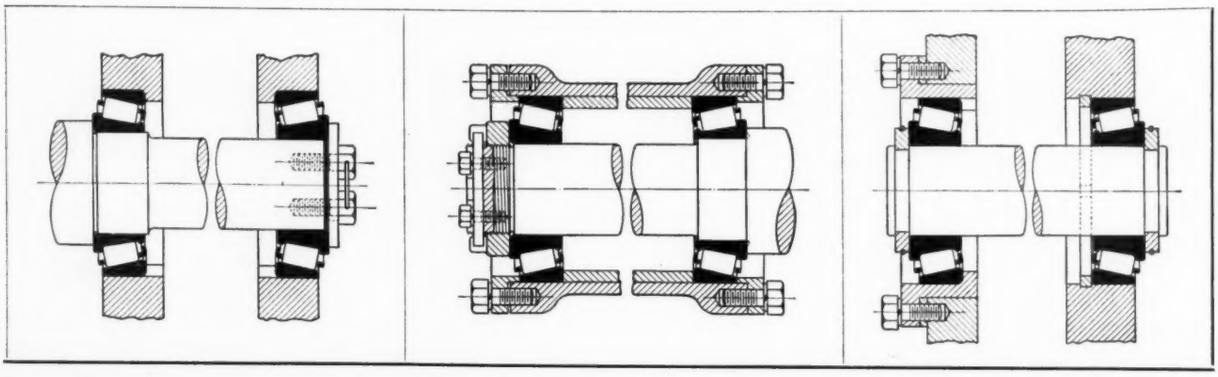
Development through research and field study has shown that maximum efficiency in a tapered roller bearing requires positive alignment of the rolls at all times. This can be accomplished by perfecting the mechanical construction of the bearing. To do this involves proper under-cutting of the shoulder at the large end of the cone and grinding of the large end of the roll, so that it will square exactly with the center line of the roll. As the roll revolves about the cone, there will be contact between the end of the roller and the shoulder of the cone at two widely separated points, thus keeping the rolls permanently and accurately aligned, and thereby increasing the efficiency.

In considering the fundamental principles involved in mounting tapered roller bearings, it should be remembered that it is impractical to mount them singly. Owing to the tapered construction, a radial load on one bearing sets up a thrust reaction which must be carried by the opposed bearing, thus requiring the application of this type of bearing in pairs. This may be done in two ways, ordinarily known as the direct and indirect types of mounting.

Fig. 2. Mounting in which Bearing Cups are Seated against Shoulder

Fig. 3. Method of Locating and Holding Roller Bearings with Spacer and End Caps

Fig. 4. Typical Example of Indirect Mounting of Tapered Roller Bearing



Direct and Indirect Types of Mounting

In the direct mounting, the large ends of the rollers of each bearing point in, or toward the mating bearing. In the indirect mounting, the large ends of the rollers point out, or away from the other bearing. The greater stability of the indirect mounting will be readily appreciated by referring to Fig. 5. It will be noted that while the distance A between bearing centers is the same in both types of mountings, the length of the "stability line" B_2 in the indirect mounting is nearly twice as great as the corresponding line B_1 in the direct type of mounting.

Indirect mounting is generally preferred, because of its higher stability, when the distance between bearing centers is relatively short. This is usually the case in wheels mounted on dead shafts and in idler pulleys, sheaves, drums, automotive pinions, etc. When there is a relatively long distance between bearing centers, as is the case on automotive transmission gear shafts, differential gear shafts, machine tool transmission shafts, gear reductions, etc., the direct mounting is normally used.

The type of mounting should be selected with regard to the character of the load to be carried. For example, a live shaft application with heavy thrust loading should be designed to carry the thrust on the bearing nearest to the imposed load, ordinarily using the indirect type mounting. Likewise, with an overhung bevel gear arrangement, such as a power take-off, a similar mounting should be used, since it places the large ends of the rollers adjacent to the heavy radial load. Conversely, in a live shaft application where there is a heavy gear load or belt pull between two bearings, the direct mounting should be used, so as to place the large ends of the rollers next to the load.

In an article of this nature it is naturally impossible to show all the methods by which tapered roller bearings can be applied. Frequently cases arise that call for an entirely different type of mounting or for combinations of mounting methods. However, the fundamental principles remain the same, and the following examples illustrate basic types of mountings having wide application.

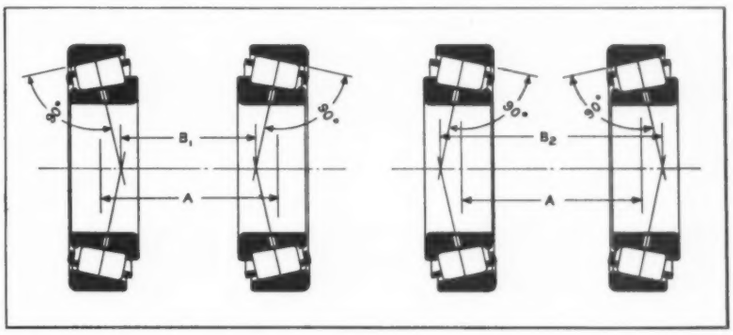


Fig. 5. (Left) Direct Type of Mounting; (Right) Indirect Type of Mounting

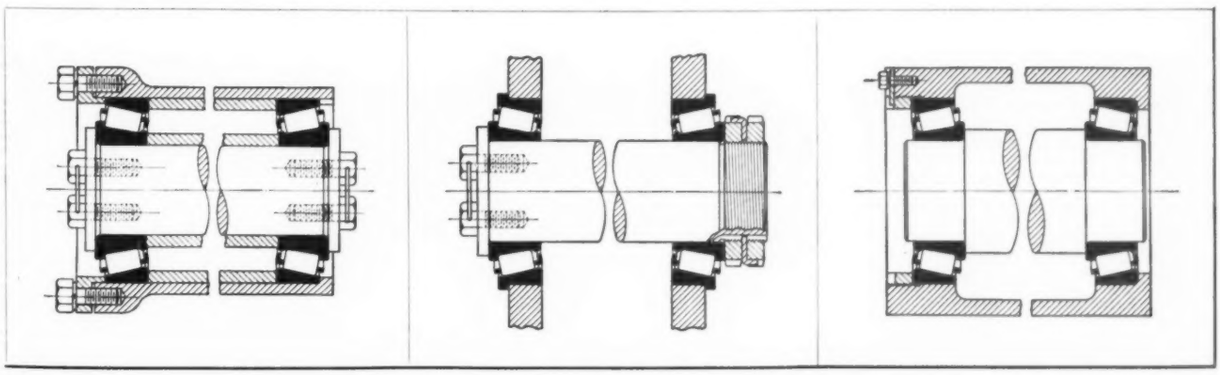
Fig. 2 illustrates a simple mounting in which the bearing cups are seated against a shoulder, knockout slots being provided to facilitate disassembly. It will be noted that the left hand (inner) bearing has a larger bore than the one at the right (outer), and backs up against a shoulder on the shaft. It is always preferable to have the inner bearing slightly larger than the outer one to avoid the necessity of pressing the cone a considerable distance along the shaft.

Ample backing for the inner cone should be provided, but provision should be made for disassembly. Bearing set-up is secured in this type of mounting by means of shims and a steel plate. This eliminates the necessity for threading the shaft, and at the same time makes possible a close adjustment of the bearing. The shims and plate are

Fig. 6. Roller Bearing Assembly of Non-adjustable Type with Cup and Cone Spacers

Fig. 7. Flanged Cup Type of Mounting with Cup Backing Formed by Machined Housing

Fig. 8. Standard Application of Direct Type Mounting with Cup Shoulder in Housing



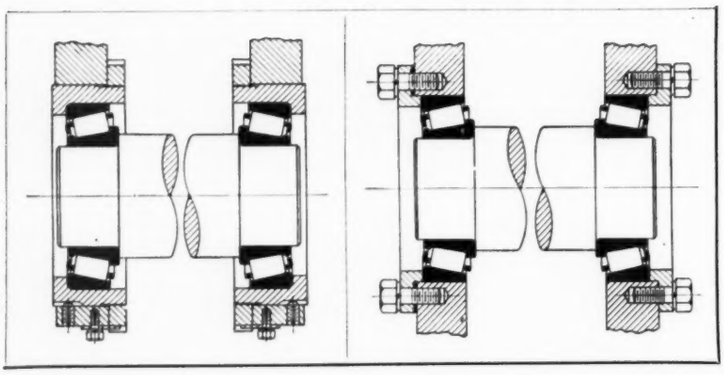


Fig. 9. (Left) Mounting Used when Gears or Other Parts Must be Located Accurately

Fig. 10. (Right) Direct Type Mounting Used in Gear Reduction Units

held in place by cap-screws, and a slot should be provided in the plate so that a gage can be used to determine the thickness of shims required.

At times it is impractical to locate the cups against shoulders machined in the usual manner. In such cases, the cups may be located through the use of a spacer and suitable end caps, as shown in Fig. 3. The bearing set-up is secured through the use of a special nut locked in place by a plate set in a slot machined in the end of the shaft. When fine adjustment is desired, a second slot at right angles to the first is provided. The plate is locked in place by means of cap-screws, as shown.

Fig. 4 illustrates a typical indirect mounting in which snap-rings are used to provide backing for the bearing. The right-hand bearing cup in this example is seated against a shoulder in the housing formed by inserting a square snap-ring in a properly machined groove. The cone bears against a split ring set in a groove in the shaft, and a similar ring is used to back up the cone of the opposite bearing. Either a clamping spring or G-wire may be used to hold the split rings together. The cup on the left-hand bearing is mounted in a carrier, and proper bearing set-up secured by means of an accurately ground split spacer inserted between the flange of the carrier and the face of the housing.

Certain types of assemblies are such as to make provision for bearing take-up unnecessary, or operating conditions may be such as to require a fixed mounting at one end of an assembly and a certain amount of "float" at the other. Fig. 6 illustrates a non-adjustable assembly. In this case, spacers are inserted between both the cups and the cones. As shown, the outer end of the right-hand cup is located against a shoulder in the housing, the spacer furnishing the backing for both cups. At the left, the cup is locked against the spacer by means of a cup follower held in place by cap-screws. The spacer sleeve between the cones is accurately ground to provide the predetermined bearing set-up, and the entire assembly is securely locked in position by means of plates attached to each end of the shaft by cap-screws.

In some designs, it is impossible to provide the usual form of cup backing, and then flanged cups are used. In such a case, as illustrated in Fig. 7, the housing face is machined to form a backing for the cups. As shown, cone backing may be obtained by means of a heavy plate held in place by cap-screws at one end of the shaft, and bearing set-up made at the other end by means of two nuts and a tongued lock-washer. Or one cone may be backed against a shoulder on the shaft, while the other is backed by an accurately ground split ring, held in place by a snap-ring in a machined groove in the shaft.

In practically all applications using the direct

Fig. 11. Bearing with Cups Held in Place by Snap-ring and Plate Secured by Cap-screws

Fig. 12. Design in which Spacers are Used to Provide Backing for Bearing Cones

Fig. 13. Typical Cone-adjusted, Self-aligning, Two-bearing Type of Mounting

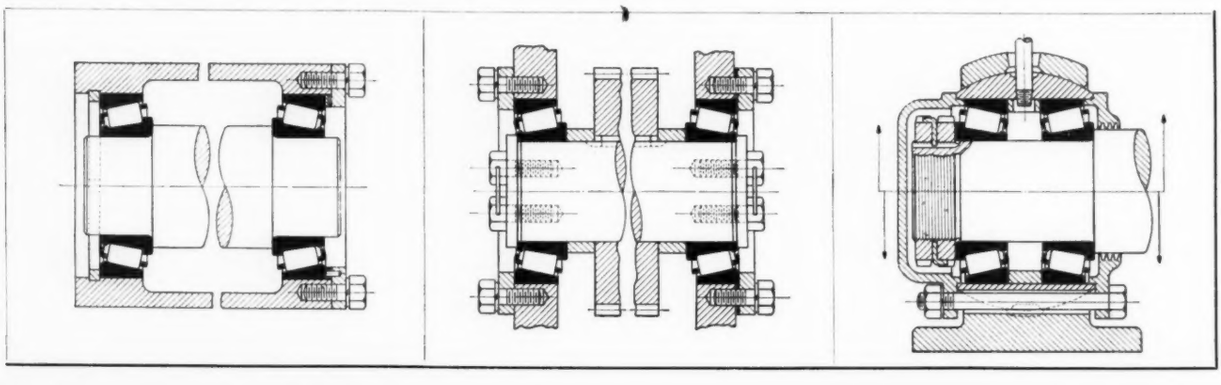
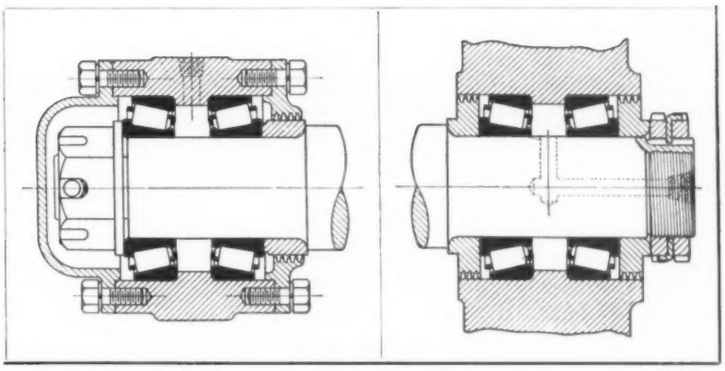


Fig. 14. (Left) Mounting Adapted for Either Live or Dead Shaft Installations

Fig. 15. (Right) Mounting Designed Primarily for Dead Shaft Use



type of mounting discussed at the beginning of this article, the cones are set against shoulders on the shaft, as shown in Fig. 8, although other types of backing may be used where special conditions require them. In this standard application, one cup is set against a shoulder in the housing, while the companion cup is secured through the use of a threaded cup follower, which should be clamped firmly in position and held by means of a suitable locking device.

Mountings for Bearings that Require Accurate Location

When it is necessary to locate gears or other parts accurately, a method such as is shown in Fig. 9 may be used. In this case, the cones are mounted on the shaft in the usual way, while the cups are inserted in carriers. This permits the entire assembly to be adjusted to any desired position, so as to obtain the proper adjustment of gear teeth or other parts by means of the special nuts, which also provide for bearing set-up. The threads in a design of this nature should be close fitting, and if possible should be clamped. The cup carriers are prevented from rotating by means of set-screws, which are inserted through the housing to engage keyways machined in the outer diameter of the carrier.

In a similar mounting, used extensively on automotive differentials, the cups are mounted directly in the housing. Here both the assembly and the bearing adjustment can be secured through the use of threaded cup followers back of each cup.

Fig. 10 illustrates an effective method of direct mounting used with good results in gear reduction units. In this mounting, the cups are backed by followers held in place by cap-screws. The proper bearing adjustment is obtained by using shims between the flange of one cup follower and the face of the housing. In a modification of this mounting, carriers are used for the cups.

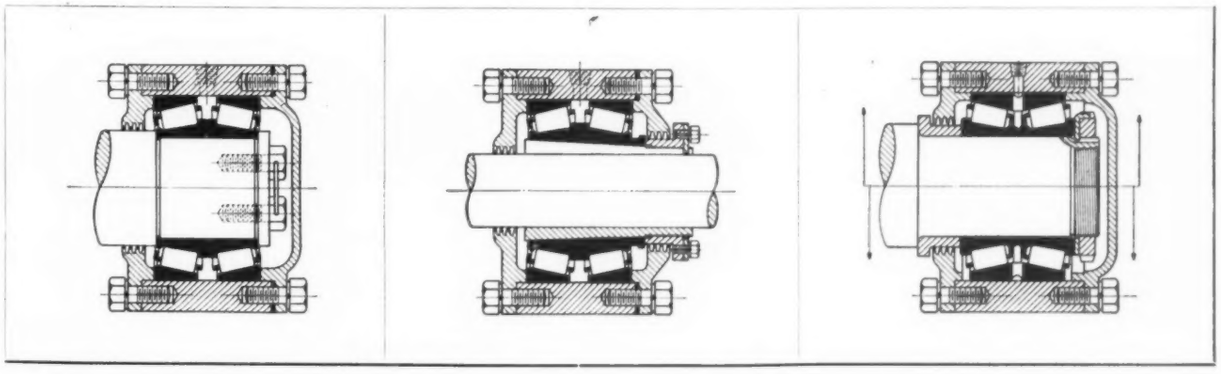
In Fig. 11, the left-hand cup is set against a shoulder in the housing formed by inserting a snap-ring in a suitably machined groove, while the cup on the right is backed by a plate held by cap-screws. Shims and a spacer against the back face of the right-hand cup provide for bearing set-up. A pin with a heavy push fit in the plate, engaging holes in the shims, will prevent their rotation.

Spacers provide backing for the cones and also serve to locate other parts accurately in the mounting shown in Fig. 12. The cones are held firmly against the spacers by plates secured by cap-screws. The cups are mounted in the housing and backed up by end rings secured by cap-screws. Bearing set-up is secured by shims introduced between one cup backing ring and the face of the housing.

Fig. 16. Cup-adjusted Type of Mounting for Tapered Roller Bearing

Fig. 17. Design of Double Cone Bearing Mounting having Tapered Sleeve Construction

Fig. 18. Mounting for Non-adjustable Bearings, with Provision for Locking Cones to Shaft



Self-Aligning Mounting

Fig. 13 shows a typical cone-adjusted, self-aligning, two-bearing mounting. Both cups are mounted in a spherical box and properly separated by means of a spacer. The section shown above the center line illustrates the mounting for a fixed box, while that below the center line shows the mounting for a floating box. The mountings are the same, except that the pilots on the end caps shown below the center line are sufficiently short to permit the bearings to float in the box. Adjustment is secured by means of two nuts and a tongued washer. Although in the design shown, the end caps are held in place by through bolts, which also serve to prevent the spherical box from rotating in its seat, cap-screws may be used to bolt the end caps to the housing, and a pin driven into the main housing to prevent rotation of the spherical box.

Designs for Live and Dead Shaft Mountings

Another cone-adjusted, two-bearing mounting is shown in Fig. 14. In this design, the housing is counterbored from each end to provide proper backing for the cups, adjustment of the bearing being provided by means of a castellated nut fitting against the outboard bearing cone. This design is applicable to either live or dead shaft mountings.

In Fig. 15, the design is primarily adapted to dead shaft mountings, although, on occasion, it may be applied to live shafts. Here, again, the housing is counterbored from both ends to provide proper backing for the cups, and adjustment is secured through the cones by means of a double lock-nut. The closures shown are interchangeable and can be used at either end. Lubrication is provided by drilling through the center of the shaft.

Cup-Adjusted Bearing Mounting

Fig. 16 illustrates a type of cup-adjusted mounting in which the cones are clamped against a shoulder on the shaft by means of an end plate bolted to the end of the shaft. The housing is bored straight through as shown, which assures perfect alignment. Adjustment is effected by a closure plate on the inside and an end cap on the outside, using shims.

A double cone bearing mounting embodying most of the principles involved is shown in Fig. 17. In this application, one cup is mounted against an end plate, which is bolted to the side of the housing and serves also as a closure. A similarly constructed end cap backs up the other cup, while shims inserted between this cap and the housing provide the necessary adjustment. It will be noted that the cone is mounted on a tapered sleeve which has a saw-cut lengthwise, so that it will compress and grip the shaft tightly as the nut forces the cone farther on the sleeve. This type of mounting finds extensive use on cold-finished shafting, since it can be moved to the desired position and then securely locked in place. If desired, a tapered cone may be applied directly to a tapered shaft and held in place by means of two nuts locked with a tongued washer; or the bearing may be locked on the tapered shaft by means of an end plate and cap-screws. Of course, a straight-bore bearing may be used for double cone mounting, and a common method is to set the cone against a puller sleeve.

Mounting for Non-Adjustable Bearing

Timken non-adjustable bearings are also available. These bearings are manufactured with the proper running clearance, and with no provision for field adjustment. In Fig. 18, the cones are shown butted together and locked securely on the shaft by means of a tongued washer and nut. A puller sleeve is used back of the bearing to facilitate removal. A fixed box construction is shown above the center line in the illustration, while the arrangement shown below provides for "float" by shortening the pilots on the end caps. Various methods of locking the cones in place on the shaft may be used, as indicated in other set-ups, and the type of closure selected may also be changed to meet specific needs.

The foregoing summary indicates the wide variety of methods of mounting Timken bearings, but does not attempt to cover all types or all applications. General applications should have from 0.001 to 0.005 inch end play, but special conditions involving elimination of vibration, chatter, extremely high speed, or abnormal heating should be discussed with the bearing manufacturer's engineering department.

In detailing the bearing housing, covers, shaft, etc., provision should be made for machining variations, and unless non-adjustable bearings are used, for future bearing adjustment. When shim adjustment is used, a space of 3/32 inch should be provided for the shims. This will be sufficient for all normal machine variations and will provide a few additional shims for service adjustment. In making the assembly, it may be found desirable to place some of the shims at each end of the bearing housing to facilitate adjustment. When threaded adjustment is used, a space of 3/32 inch should likewise be provided.

A sufficiently wide range of sizes of Timken bearings is available for shafts 3/8 inch in diameter up to steel mill roll necks over 30 inches in diameter. Capacities vary widely, depending upon speed, loading, type of service, and length of life desired.

* * *

What is believed to be the largest all-welded ship in the world is being built, according to *Industrial Britain*, in Great Britain by Swan, Hunter & Wigham Richardson, Ltd., for the Ontario Paper Co., Ltd. This ship will have an over-all length of 259 feet, a width of 43 feet, and a depth of 22 feet, and will have a paper-carrying cargo capacity of 2400 tons.

Precision Boring as a Production Operation

The Use of Diamond and Cemented-Carbide Tools Has Created the Need for Boring Machines of the Precision Type—Second of Two Articles

By C. A. BIRKEBAK, Engineer
The Ex-Cell-O Aircraft & Tool Corporation, Detroit, Mich.

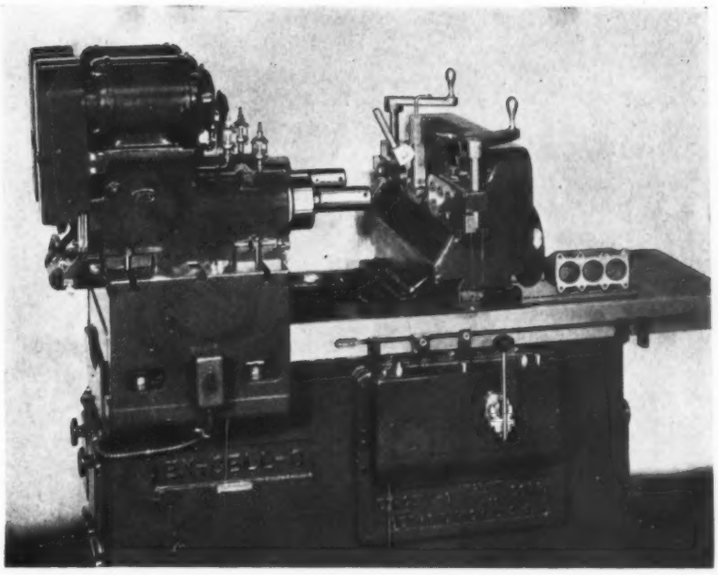


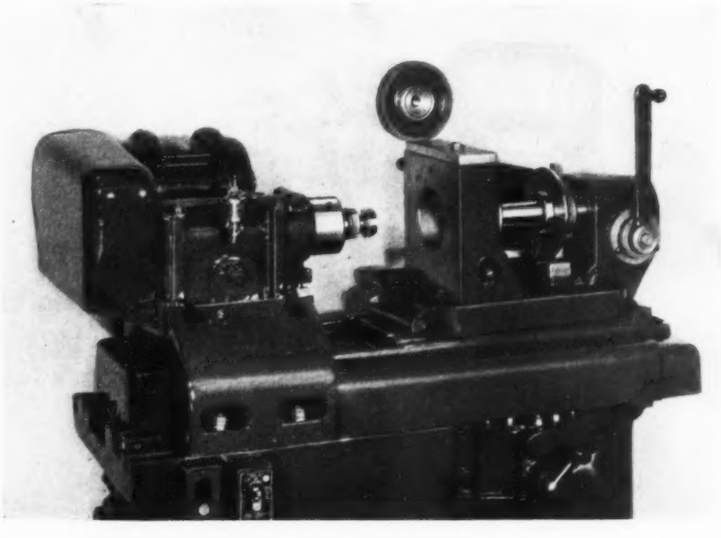
Fig. 5. Indexing Fixtures are Provided on the Machine Shown for the Precision Boring of Cylinder Blocks

THE first installment of this article was published in June MACHINERY, page 606. The present installment is a continuation, dealing with additional applications.

Three cylinder holes are bored in aluminum and cast-iron air-compressor cylinder blocks by means of the machine shown in Fig. 5. Blocks of three different sizes are handled, the bores being 2.3745, 2.375, and 2.4395 inches in diameter. In boring these cylinders, the depth of cut ranges from 0.004 to 0.005 inch. In the operation on aluminum blocks, the boring spindle runs at 3500 revolutions per minute, the feed is 0.0015 inch, and the production averages 42 blocks an hour, while on the cast-iron blocks the boring spindle runs at 700 revolutions per minute, the feed is 0.002 inch, and the production averages 10 blocks an hour. Diamond tools are used in boring the aluminum cylinders, and tungsten-carbide tools for the cast-iron cylinders.

The cylinder blocks are located in the fixture on dowels that register in previously reamed holes. Cam clamps hold the blocks securely for the boring. The indexing arrangement provides for boring all three cylinders of two blocks in one set-up. Indexing is accomplished by releasing the clamp handle that locks the fixture cross-slide to its base and then turning a handwheel on the right-hand side of the fixture until the cylinder blocks have been positioned for boring the next holes. The cross-slide is then locked again to the fixed base.

Fig. 6. Precision Boring Machine Set up for the Accurate Machining of a Blind Hole in Steel



The equipment shown in Fig. 6 was designed for boring a 2 1/2-inch hole, 3/16 inch deep, in a steel bushing inserted in the center of phenolic plastic timing-gear blanks. By using tantalum-carbide tools, a production of 144 gear blanks is obtained an hour. The depth of cut is from 0.006 to 0.0075 inch, the feed 0.006 inch, and the spindle speed, 600 revolutions per minute.

The timing gear is approximately located for this operation by means of a three-point device which is applied to the outside diameter of the blank. A hand-

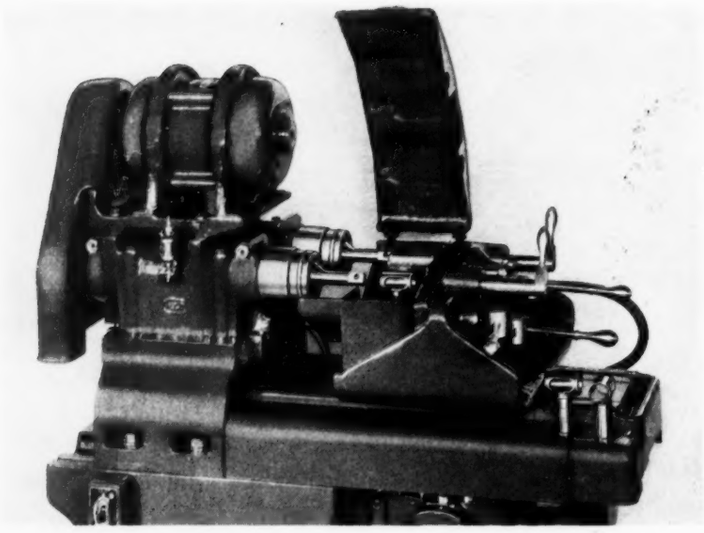


Fig. 7. Steel Tube Piston with Large Hole in One Side, Bored at the Rate of 137 an Hour

operated plug on this device is then inserted in a 7/8-inch bore in the steel bushing of the gear, thus bringing the blank accurately into alignment with the boring spindle. The hand-crank on the right-hand end of the fixture is now operated to lock a swivel clamp firmly against the right-hand side of the work, after which the locating plug is removed and the part is ready for the boring operation.

Electric refrigerator pistons constructed of two pieces of steel tubing, as seen on the right-hand end of the table in Fig. 7, are bored successfully on the machine shown, in spite of the fact that the wall of the bore is interrupted by a large hole. In addition to the interrupted cut, the light construction of the part and the fact that the bore wall is considerably heavier at the point where the two pieces of tubing are brazed together presented difficulties when the piston was machined with the equipment previously used. A high finish and a bore that is round within close limits are important requirements in producing this part.

The specified bore diameter is 1.250 inches. The cut is taken at a depth of from 0.006 to 0.0075 inch and at a feed of 0.007 inch. The spindle speed is 1375 revolutions per minute. Tantalum-carbide tools are used, a production of 137 pieces an hour being obtained.

In loading this machine, each piston is placed in a floating V-block and approximately lined up by means of an equalizing support. A locating plug is then inserted in the hole to be bored for aligning it accurately with the boring spindle. The floating V-block is next clamped by turning a handle, after which the locating plug is removed from the part, making it ready for the boring cycle.

On the machine base in Fig. 8 may be seen a connecting-rod for electric refrigerators, which is bored at one end to a diameter of 3.126 inches, and at the other end to a diameter of only 0.500 inch. These connecting-rods are made of semi-steel and are machined with tungsten-carbide tools. Larger connecting-rods with bronze bushings are also bored with this equipment to diameters of 4.8145 and 1.1253 inches. In addition, this machine is arranged for taking a facing cut on refrigerator seals.

The connecting-rod is aligned in the fixture by means of plugs which are inserted in the bores at each end. A floating V-block holds the small end of the work accurately in position, while the large end is positioned by means of a rocker clamp that is brought against the finished face by tightening a screw. Both holes are bored at the same time, the depth of cut in each case being from 0.004 to 0.005 inch.

When the machine is set up for facing the refrigerator seals, a spring chuck is mounted on the nose of the rear boring unit for holding one seal at a time. The facing cut is taken by a single-point tool held by an offset arm which is mounted on the fixture cross-slide. Each seal is faced from the center to the periphery as the tool is fed across it by moving the fixture cross-slide. The facing cut is taken at a depth of from 0.004 to 0.006 inch by a diamond tool. The seal is 2 1/32 inches in diameter and is revolved at a speed of 1430 revolutions per minute. The production averages 80 pieces an hour.

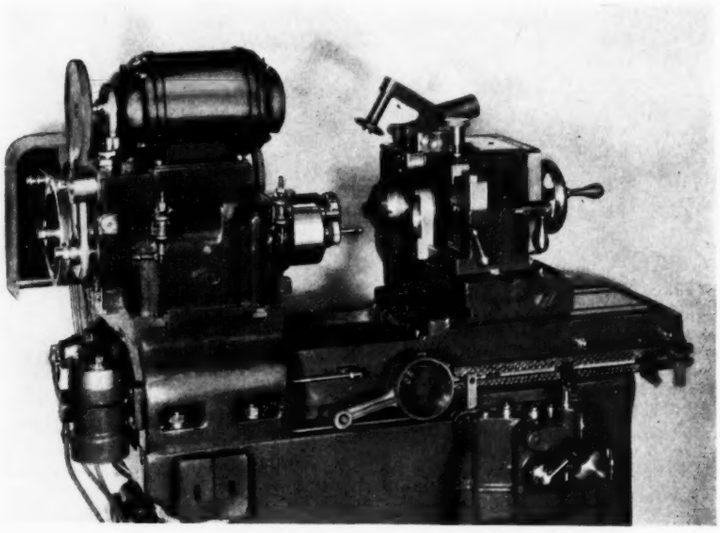


Fig. 8. Machine Set up for Simultaneously Boring Two Holes that Vary Greatly in Diameter

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

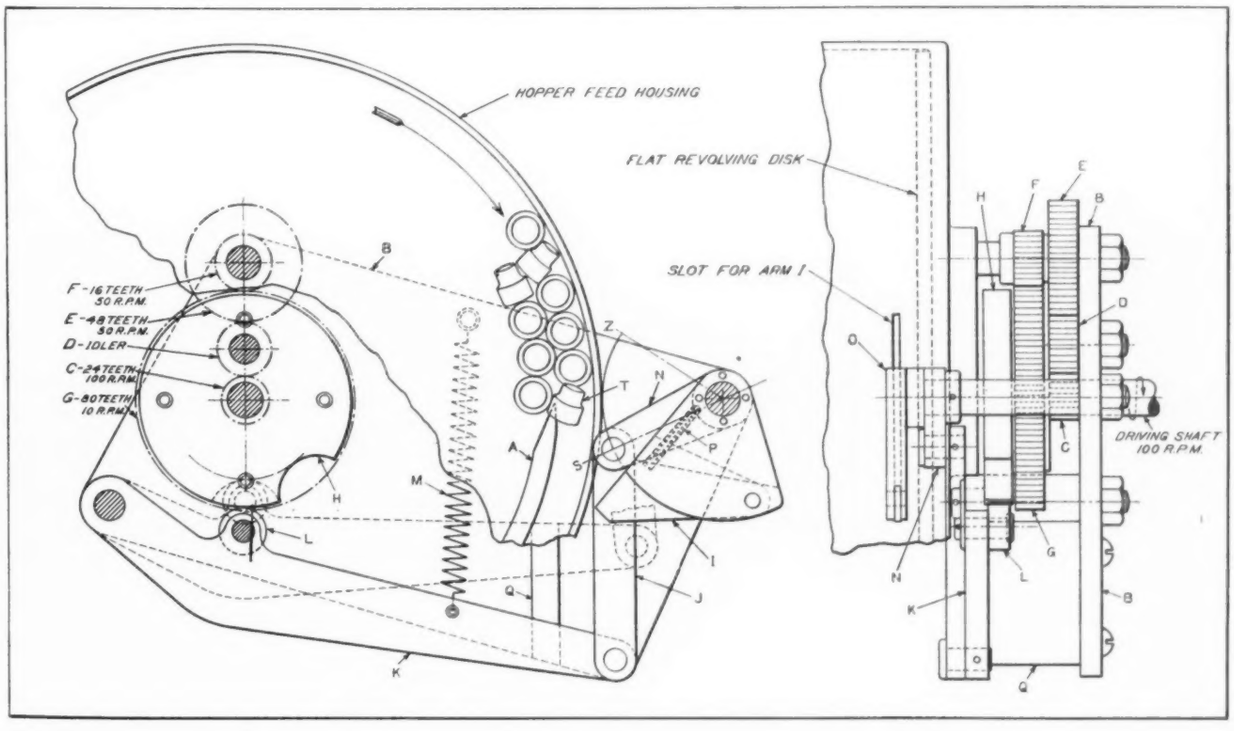
Oscillating Arm Mechanism for Dislodging Pieces that Obstruct Hopper Feed Exit

By EDWARD LAY

Anyone using hopper feeds of the flat, revolving disk type shown in the illustration has probably experienced trouble from jamming of the work on the aligning strip *A* at the point where the pieces leave the hopper. The purpose of strip *A* is to line up the work so that it will enter the chute opening in a predetermined position. The clogging of the hopper exit results in loss of production and unnecessary wear on the punch and die members. As an operator often runs three or four presses of this kind, jamming or clogging of the work in the manner referred to may not be noticed immediately. In order to start the feed after clogging occurs, the trouble-causing piece *T* must be taken out by hand. This trouble has now been eliminated by the mechanism shown in the illustration.

The entire device is mounted on the baseplate *B*. This plate is secured to the under side of the hopper feed housing. The gear *C* is an integral part of the driving shaft, which revolves at a speed of 100 revolutions per minute. The idler *D* transmits motion to the cluster gears *E* and *F*. Gear *F* meshes with gear *G*, which is free to revolve around the driving shaft and is riveted to cam *H*. Cam *H* revolves at 10 revolutions per minute.

The piece of work *T* which has obstructed the exit of the hopper is swept away or dislodged in the following manner: The circular cut-out on the cam *H* causes a sweeping motion of arm *I* from *S* to *Z* when the cam-roll *L* drops into the cut-out. The cam-roll is attached to lever *K*. Link *J* connects lever *K* to lever *N*. Lever *N* is riveted to the holder *O* of the arm *I*. Cam-roll *L* is kept in contact with the periphery of the cam by spring *M*. The small spring *P* provides flexibility for the arm *I* on the return movement. The shoe *Q* serves as a guide and steadyrest for lever *K*. The mechanism described can, of course, be applied to work of various shapes by making suitable alterations.



Revolving Disk Type Hopper Feed with Mechanism for Dislodging Clogged Pieces

Mechanism for Adjusting Operating Position of Reciprocating Slide

By J. E. FENNO

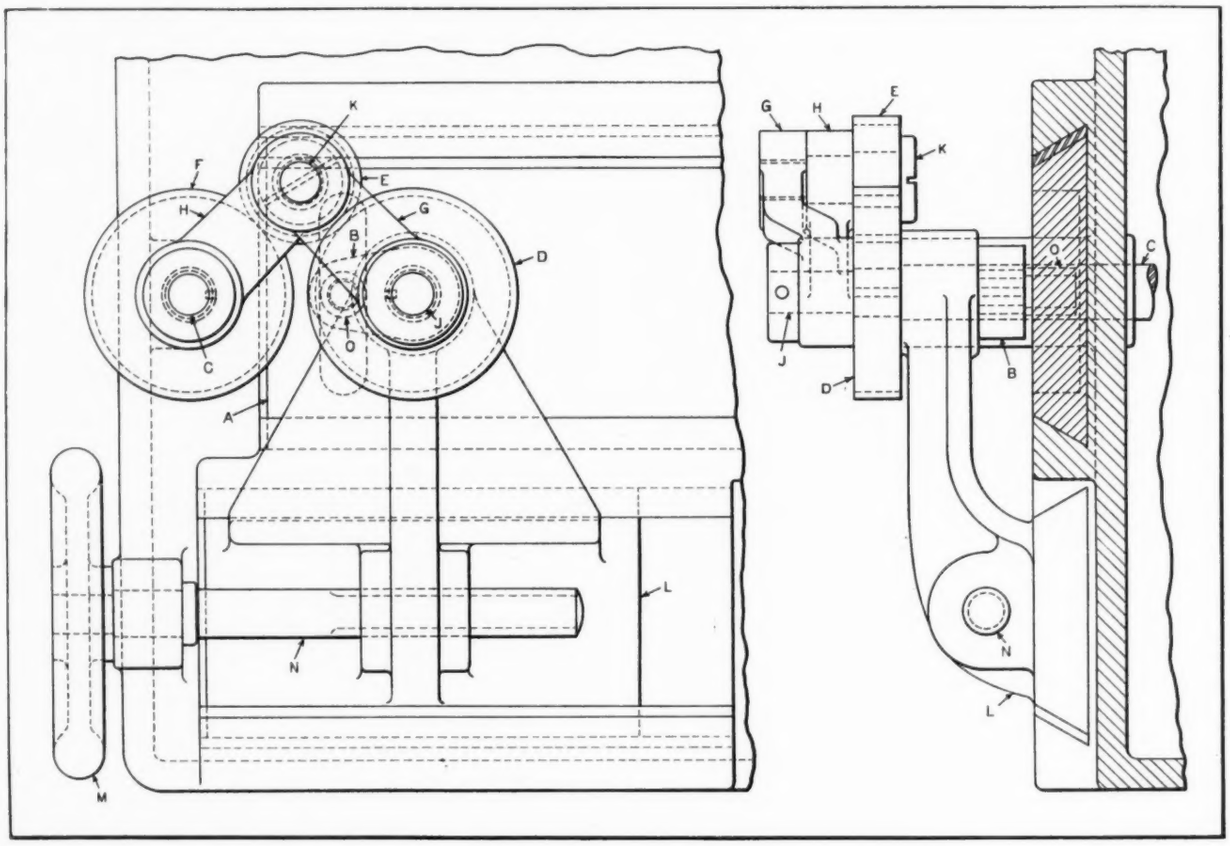
Occasionally it is necessary to provide means for adjusting the operating position or point of reversal of a slide having a fixed length of stroke without stopping the motion of the slide. A parallel to this requirement is found in a vertical shaping machine, in which the reversal point of the tool-slide is varied manually, in order to allow the tool to clear obstructions on the work.

The mechanism for obtaining this variation is shown in the illustration, the tool-slide being indicated at *A*. This slide is actuated by the crank *B* keyed to shaft *J*. Shaft *J* is driven by shaft *C* through gears *D*, *E*, and *F*. Roll *O*, mounted on a stud in crank *B*, engages a groove in the tool-slide and operates on the principle of the Scotch yoke.

The center distances between gears *D* and *E* and between gears *E* and *F* are maintained by the links *G* and *H*, respectively. These links are a free fit on the gear-shafts *J* and *C*. Gear *E* and link *H* are also a free fit on screw *K*. Shaft *J* turns freely in a bracket cast integral with the adjusting slide *L*, and this slide is actuated by the handwheel *M* on the feed-screw *N*. Screw *N* engages a nut cast on slide *L*.

Slide *A* is shown in its extreme left-hand position. Assume that both the left-hand point of reversal and the right-hand point of reversal are required to occur farther toward the right. To effect this change, the operator merely turns handwheel *M* the required amount or until slide *L* has carried shaft *J* a corresponding distance toward the right. In doing this, the links tend to straighten out, yet the gears remain in mesh and continue the rotation of the crank.

The range of variation for changing the point of reversal is controlled by the diameters of the gears. If a larger idler gear *E* is used, the slide will have a greater range of adjustment.



Reciprocating Slide with Mechanism for Adjusting Operating Position

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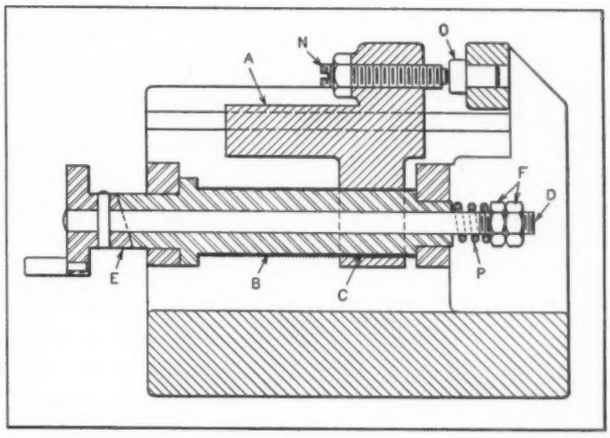
Overload Slip Arrangement for Feed-Screw

By JOHN A. HONEGGER

Various types of machines require overload slip arrangements designed to prevent damage to some part of the mechanism when the maximum load is applied. If the slip arrangement can be so designed as to allow for the application of varying loads, it can be used on other mechanisms. The arrangement shown in the accompanying illustration was developed by the writer to meet such requirements.

The slide *A* of this mechanism is carried back and forth by means of a threaded sleeve or feed-screw *B* in the threaded hole *C*. The rod *D* passes through sleeve *B* and has a handwheel pinned to one end. The hub *E* of the handwheel has a cam-shaped end which is in contact with a similar cam face on the end of sleeve *B*. The opposite end of rod *D* is threaded and fitted with lock-nuts *F*. When the handwheel is turned until the screw *N* comes in contact with button *O*, any additional movement of the handwheel will cause the cam face on hub *E* to ride up on the cam surface on sleeve *B*, compressing the spring *P*. When the cam load reaches the high point, spring *P* causes rod *D* to return to its original position.

Varying pressures from zero to maximum can be obtained either by adjusting nuts *F* to vary the loading of spring *P* or by increasing or decreasing the angle on the cam faces of the handwheel hub and sleeve *B*. Both the spring pressure and the angle of the cam faces can, of course, be adjusted when this seems desirable.



Feed-screw Operated by Handwheel that Ceases to Turn the Feed-screw when the Slide Meets Obstruction or is Overloaded

Mechanism for Making Quick Change in Angular Positions of Cams

The staggered production requirements and the available tool equipment for rough-turning several parts of similar design necessitated changing the angular relationship of the two principal feed-cams on one shaft for each tool set-up. The arrangement provided to permit the positions of the cams to be changed quickly to suit the machining requirements of the different parts is shown in the accompanying illustration.

Cam *A* on shaft *B* is driven by shaft *C* through keys *D* in sleeve *E*. Keys *D* operate in spiral slots *F*. Pin *G* fits in sleeve *E* and extends through slots *H* of shaft *B*. Pin *G* also extends through the shifter shaft *J* in shaft *B*.

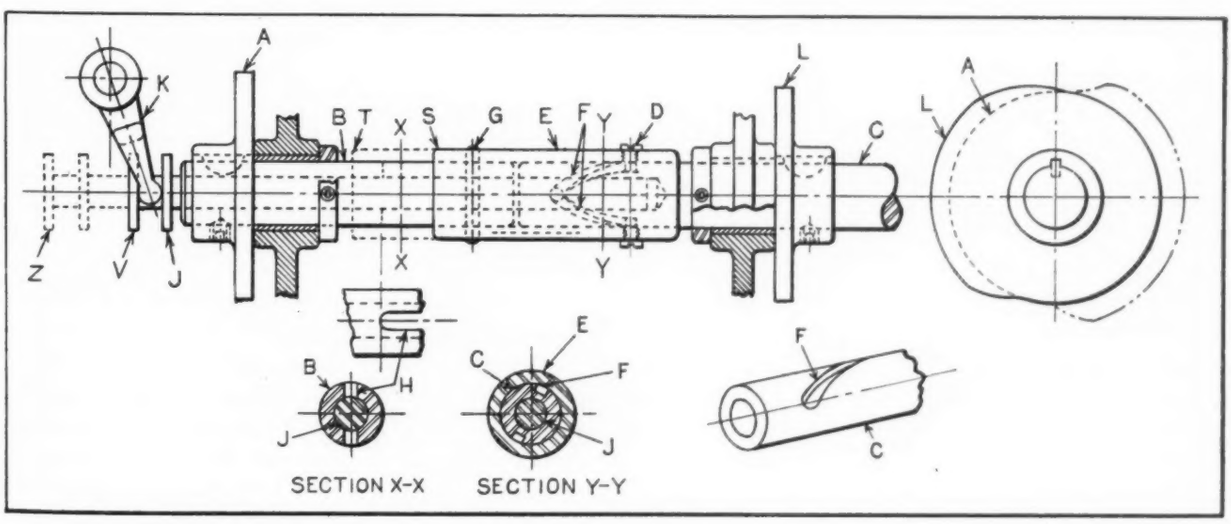
Axial movement of shifter shaft *J*, by means of lever *K*, from position *V* to *Z* causes cam *A* to advance clockwise in relation to cam *L*. This movement of sleeve *E* from position *S* to *T* causes keys *D* to operate in slots *F* of shaft *C*.

Shaft *J* is piloted in shaft *C* to maintain the alignment of shafts *B* and *C*. The follower on cam *A* is released when changing cam positions. Shifter lever *K* is provided with conventional means (not shown) for locking in any of the required positions.

R. P.

* * *

A high-powered locomotive with the largest nickel-steel cylinders ever produced is being built by the Great Northern Railroad for use on the steep grades of the Rocky Mountains. The cylinders for this locomotive weigh 7000 pounds each, and are cast from alloy steel containing 2 per cent nickel. A complete assembly of two cylinders and saddle weighs 17,000 pounds.



Mechanism for Changing Angular Positions of Cams A and L

EDITORIAL COMMENT

Much of the industrial strife witnessed during the past year has been due to a lack of understanding of the relation between production and living standards. This lack of understanding is not limited to any one group. It crops out in government departments and in the utterances of labor leaders. Some men prominent in business and industry have also voiced opinions indicating that this relationship is not clearly understood.

Yet it is one of the most important questions at the moment, because our present difficulties are due to a misunderstanding of fundamental factors.

Economic Fallacies Cause More Trouble than the Depression

Clear thinking should make it at once apparent that there can be only one result from reduced hours and reduced production—that result is a lower standard of living.

The standard of living increases when there are plenty of goods available at reasonable prices. There is only one way to keep prices reasonable and that is by the production of more commodities with the same expenditure of time and money, so that prices can be reduced and yet business remain healthy.

Any effort to prevent the application of better machinery and more efficient methods in manufacturing plants, or to reduce production or unduly limit hours, is a direct effort to *increase the cost of living and reduce the living standard.*

The only way in which the standard of living can be improved is by increased efficiency and greater production per man, so that more commodities, more cheaply produced, can be offered for sale at a price low enough to attract buyers; this, in turn, will increase employment and raise wages.

The welding jobbing shop can greatly increase its volume of work and its profits by being on the lookout for applications of welding and cutting that may never have occurred to the people for whom such work might be done. Obviously, they are less familiar with the versatility of the welding process than are those who are directly engaged in doing welding work. In industrial centers especially, there is a great deal of work now being handled in other ways, to which the welding and flame-cutting processes could be applied. It takes a man with some ingenuity to recognize these opportunities. He must know the possibilities inherent in his welding equipment, and he must be alert to perceive a new application by casual observation.

More Work for the Welding and Cutting Shop

The ability and ingenuity of the welding operator himself play an important part in the success of a welding jobbing shop. If he is able to make difficult repairs and to save equipment that could not be repaired by any other method, he will soon give his shop a reputation for exceptional work.

As a rule, most of the work that can be successfully done by welding will not come to the welding shop unsolicited. It is for the shop to point out the advantages and savings that can be accomplished by welding and to bring in work that would not have been brought to the shop without solicitation. The jobbing shop can do much to make manufacturers "welding minded," so that welding, instead of being the last method thought of, will be the first to be given consideration.

Safety of operation is being given ever increasing attention by designers of power presses. The huge presses that shape the seamless-steel turret tops for the Pontiac and Chevrolet cars show striking examples of this tendency. Adjustments for different die heights are made through electric motors operated by push-button controls. The operators are safeguarded by the use of duplicate sets of control buttons, two starting and two stop buttons being provided for each operator, so that the press cannot be started until every operator, when there is more than one, has placed both hands on the starting buttons. Furthermore, the operators must keep their hands on the buttons until the die has closed; the press then stops automatically at the top of the stroke after completing a cycle.

Safety of Operation is Being Given More and More Attention

Die-Casting with Machines of Simple Design

Thousands of Small Parts Can be Die-Cast at High Production Rates with Inexpensive Equipment–First of Three Installments

By CHARLES O. HERB

DIE-CASTING is sometimes thought of as a process that requires automatic machines involving a comparatively high initial investment. Such an impression is decidedly wrong, as will be apparent from Fig. 1, which shows a number of dies made for die-casting various parts in small hand-actuated semi-automatic machines built by the Madison-Kipp Corporation, Madison, Wis. The Kippcasters, as these machines are called, were originally intended for use under conditions of limited production, but they have proved speedy enough to meet the production requirements on certain parts for large automobile plants. Beneath the die sets in Fig. 1 are shown the castings produced by them.

This article will describe several dies designed by the concern mentioned specifically for use on machines of the semi-automatic Kippcaster type. In an operation on these machines, the operator revolves a spoked wheel counter-clockwise to close the movable half of the die against the stationary member. At the same time, the metal pot and gooseneck are automatically rocked forward into the casting position. The operator then steps on a foot-pedal to lock a toggle which holds the dies closed during the operation. An air-valve lever is next moved to actuate the piston of an air cylinder, which causes a plunger to move downward in the melting pot and force metal into the die cavity.

After the short interval required for casting, the air-valve handle is pulled toward the operator, so as to withdraw the metal-forcing plunger to its upper position. A second foot-pedal is then depressed, unlocking the die halves and partially open-

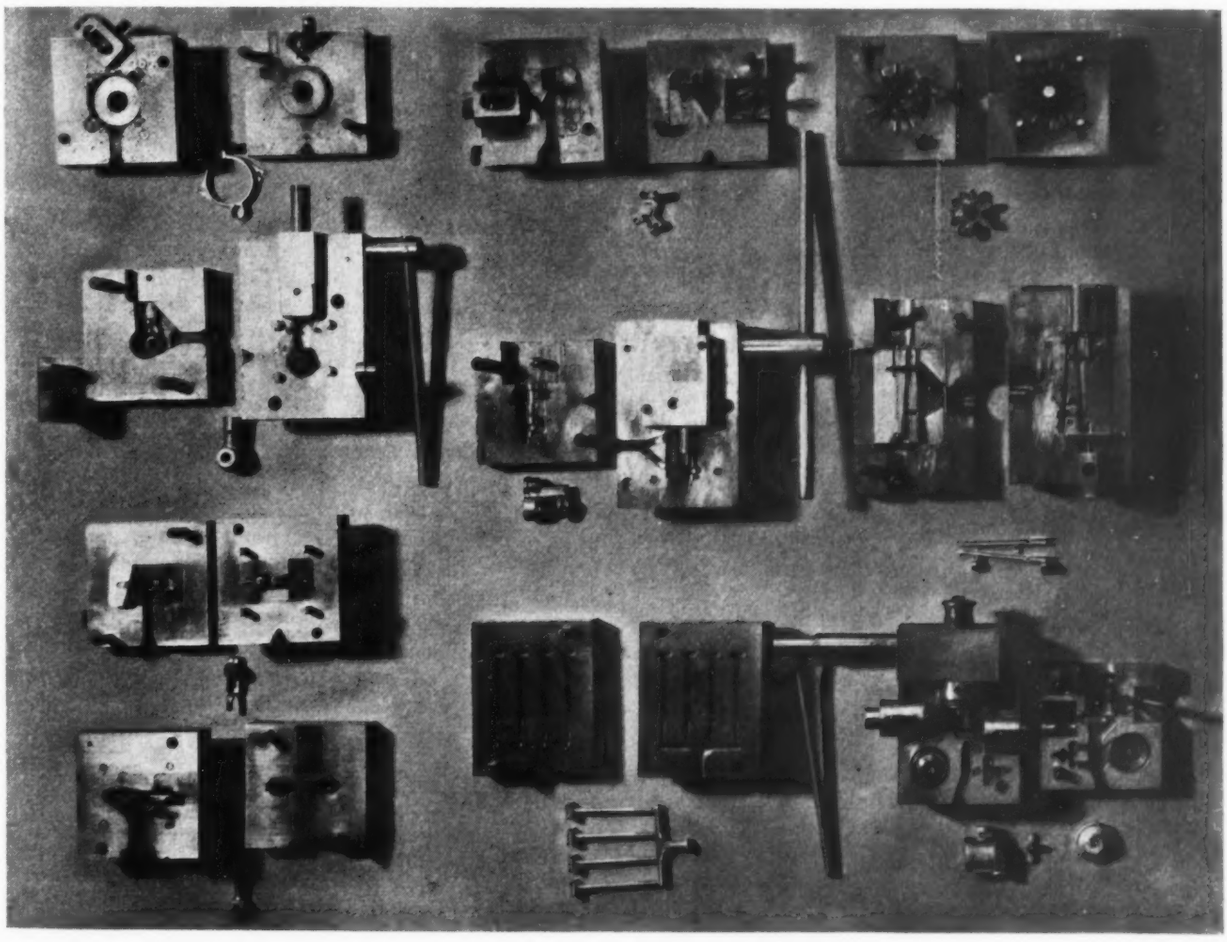


Fig. 1. Dies that Indicate the Possibilities of Die-casting Parts Singly and in Multiple in Small Semi-automatic Machines

ing them, after which the spoked wheel is turned clockwise to complete the opening of the die and eject the casting. The metal pot and gooseneck are rocked into their idle position simultaneously with the opening of the die.

Dies 6 inches square by 3 inches thick are standard for these machines, but the die dimensions can be varied considerably, depending upon the pressure area of the cavity and the weight of the casting. The die investment is relatively small, and the dies can be readily interchanged to suit production requirements. From four to ten "shots" can be made a minute with these machines, and several pieces can often be cast with each "shot." Castings weighing up to a pound have been cast by the machines referred to.

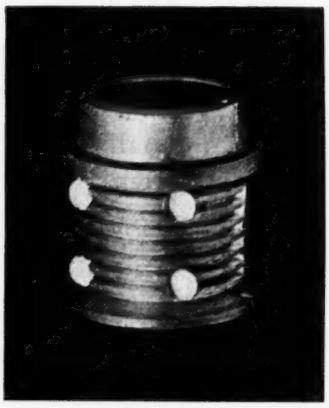


Fig. 2. Lead Bushing Die-cast at the Rate of 1600 an Hour

Sixteen Hundred Die-Castings an Hour with Semi-Automatic Equipment

Lead battery bushings such as shown in Fig. 2, which are about 7/8 inch outside diameter by 7/8 inch long, are cast at an unusually high rate of production by means of the dies shown in Fig. 3. Eight pieces are cast at a time and four "shots" are averaged a minute. Figuring on an hour of only 50 minutes, the production per hour is 1600 pieces.

These bushings were formerly hand-poured in gravity molds. Not only has the rate of production been increased tremendously by die-casting them, but the previous high scrap loss due to defective pieces has also been eliminated.

The arrangement of the eight cavities will be understood from the left-hand view, Fig. 3, which illustrates the movable die. The parting line of the die is stepped rather than straight. Its path is indicated by letters *X* in the right-hand view. One half of each bushing is cast in the stationary die, and the other half in the movable die. The molten metal is forced into the die through sprue *A*, from which two leaders *Z* run to each of the eight cavities. At the point where the metal actually enters the cavities, these leaders are 7/64 inch wide by 1/32 inch deep.

A hole 9/16 inch in diameter is formed in the lead bushings by cores *B*. These cores are automatically pulled from the castings when the movable die is withdrawn from the stationary member at the end of an operation. The movement of cores *B* is effected as rollers *C*, attached to links *D*, follow the cam path *Y* on bars fastened to one side of the stationary die.

The ends of links *D* opposite the roller ends are mounted on shafts *E*, which are provided with spur gear teeth for the greater part of their length. The teeth of these pinion shafts engage rack teeth on slides *F* to which cores *B* are fastened. Hence, as shafts *E* are swiveled on their axes by the movements of links *D*, cores *B* are operated vertically in the movable die. Links *D* swing about 90 degrees to effect a 15/16-inch vertical movement of the cores. Eight pins *P*, mounted in the stationary die, lock slides *F* and their cores securely in position vertically when the movable die is in the closed position.

An unusual feature of this set of dies is a slide *G* that shears off the sprue from each piece, and thus eliminates a separate trimming operation. Slide *G* closes one-half of one end of each cavity and it contains the shallow runners through which the molten metal is forced into the cavities.

The slide is held to the face of the moving die by means of two hardened gibs. An angular hole near the right-hand end of the slide is engaged by pin *H*, which is fixed in the stationary die. When the movable die is withdrawn from the stationary member, the slide is pulled sidewise 1/4 inch as it slips along pin *H*. This sidewise movement shears the metal in the sprues that lead to the different die cavities. Slide *G* is provided with long hardened steel inserts where the shearing action occurs, and these inserts are made with fine teeth to facilitate the shearing.

Forty Ejecting Pins Remove the Work Pieces and the Sprue Metal

Four long slender pins *J* are provided for ejecting each piece from its cavity, and in addition, there are four pins *K* that actuate the shorter pins *L* for forcing the sprue metal from the die. Pins *L* are necessarily made separate from pins *K* because, being mounted in the sprue cutter, they must be moved horizontally with it. When the movable die is closed against the stationary member for a casting operation, these pins are displaced relative to each other, as may be seen in the left-hand view, but when the sprue cutter has moved to the right, the pins are axially in line for the ejecting action. The ejecting pins are indicated by crossed lines in the left-hand view.

All of the ejecting pins are brought into play when plate *M* comes in contact with rod *N* as the movable die approaches the end of its opening stroke, rod *N* being held fixed on the machine. Then, as the movable die continues its stroke for another half inch, plate *M* and the ejecting pins are held stationary, forcing the castings and the sprue from the die.

Plate *M* is attached to the movable die by six

studs *O*. Coil springs surrounding these studs return plate *M* and its ejecting pins to the position shown when the movable die is again advanced to the stationary member. Four pilot pins on the stationary die enter holes in the face of the movable die to insure proper alignment for each operation.

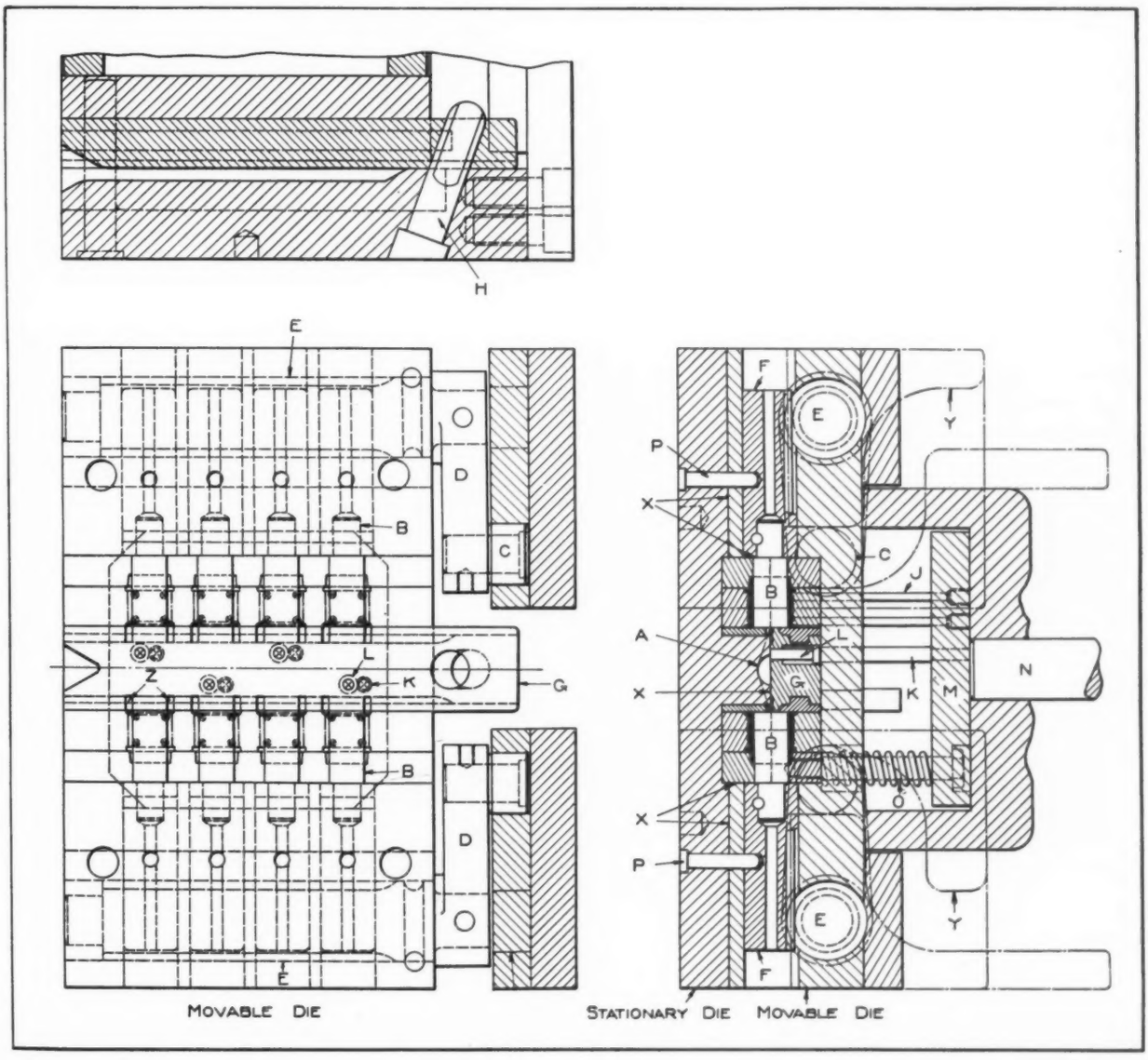
Air pressure of 80 to 100 pounds per square inch is applied directly by the air cylinder to force the plunger of the gooseneck into the molten metal for each operation. This creates a pressure of approximately 600 pounds on the molten metal where it enters the various cavities. The melting pot is held at a temperature of 750 degrees F. The various pieces that make up the cavities of these dies are made from a nickel-chromium steel. Dies of this type last year in and year out, without replacement. One set has been in continuous operation for over five years.

The universal ball seen in the center of Fig. 4 is made up of two identical pieces, which are cast in the set of dies shown in the same illustration. Both halves of the ball have raised lugs on opposite sides. On the top of one lug there is a rounded tongue, while the top of the other lug is provided with a groove to fit this lug. The two halves can be easily assembled by placing the tongue of one piece in the groove of the other.

The die shown at the left is mounted stationary on the machine, while the die at the right is moved to and from the stationary member by hand. These dies are arranged with a gate at the side instead of at the bottom, as is the case with all the dies made by the Madison-Kipp Corporation for use on the larger fully automatic machines built by the concern. The die cavity, except for the lugs, is entirely in the stationary member, as will be seen from Figs. 4 and 5, and all cores are mounted on the movable member.

During the withdrawal of

Fig. 3. Set of Dies that Produces 1600 Lead Battery Bushings an Hour in a Kippcaster



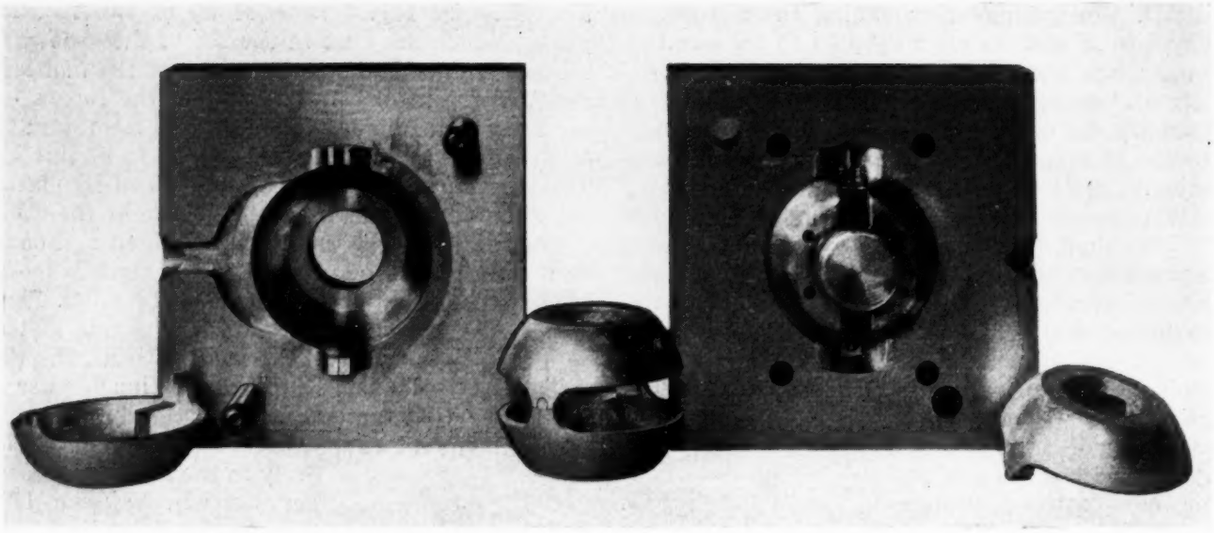
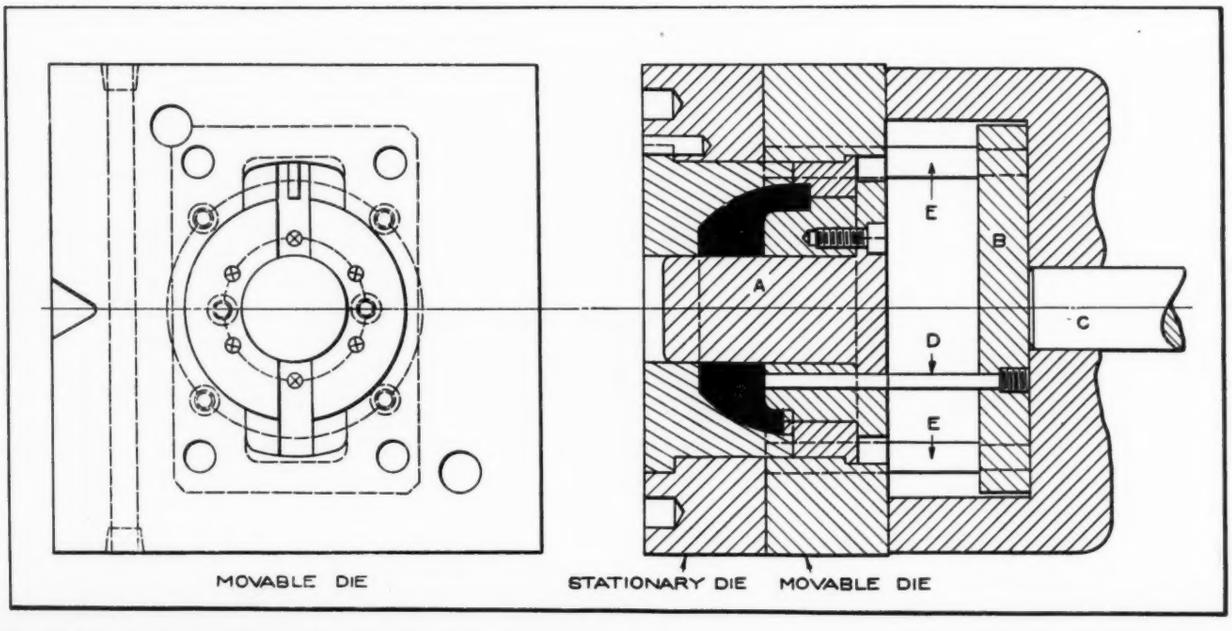


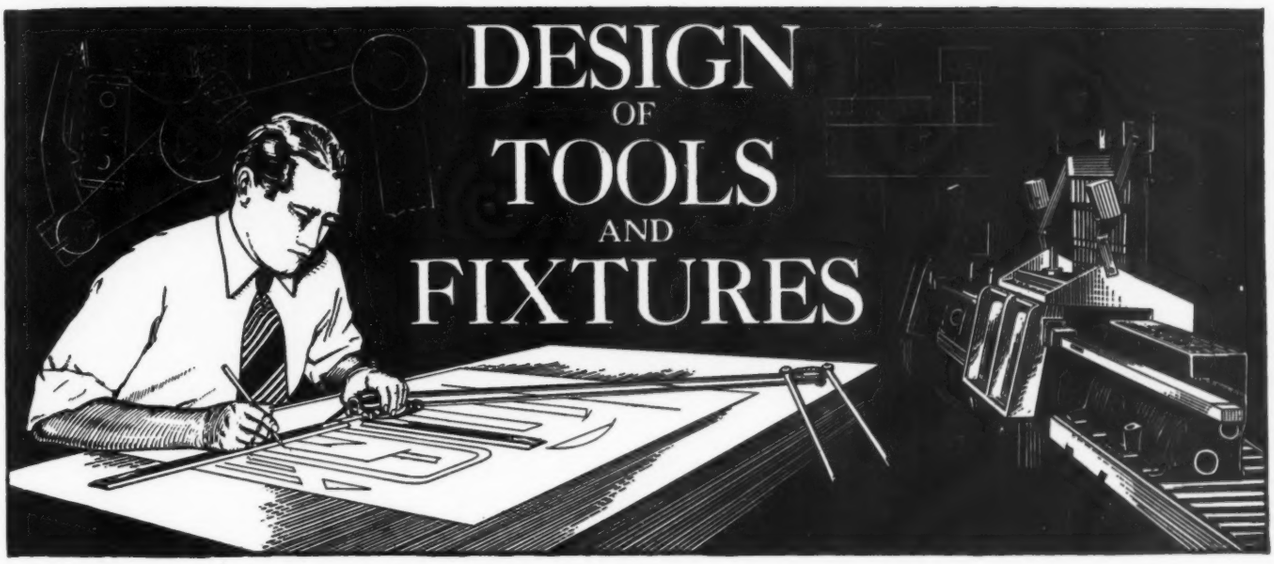
Fig. 4. Dies Used to Produce Bowl-shaped Parts, Assembled in Pairs to Obtain a Universal Ball

the movable die, upon the completion of an operation, the casting remains on core *A*, Fig. 5, until plate *B* strikes a fixed rod *C*. Plate *B* is then held stationary while the die movement is completed. Attached to plate *B* are six long slender pins *D*, which ordinarily extend through the movable die and are flush with the die cavity. However, when the movement of plate *B* is stopped, these pins enter the die cavity and eject the casting. They are again brought flush with the bottom of the cavity when the movable die is closed against the stationary member for the next operation. This occurs as four pins *E* come in contact with the face of the stationary die and return plate *B* to the position illustrated. Three "shots" are averaged per minute with this set of dies. The casting is made of zinc, and is approximately 3 inches maximum diameter. The generous gate provided can be clearly seen on the stationary die in Fig. 4. These dies should last long enough to produce 500,000 parts or more.

In August MACHINERY will be described dies designed for casting three different parts at one time; also dies for casting nuts with a square thread ready for use; and dies for casting lead terminals on insulated wire cable. These examples will further emphasize the fact that high rates of die-casting production are obtainable with machines of simple construction.

Fig. 5. Drawing that Shows the Constructional Features of the Dies Illustrated in Fig. 4





Feeler-Pin Gages Simplify Inspection

By C. COLE, Dayton, Ohio

The usual run of feeler-pin gages are of simple design. Nevertheless, they provide an effective means for gaging many parts that would otherwise require the use of much more elaborate and expensive gages. A typical gage of the feeler or flush pin type is shown in Fig. 1. This type of gage is used extensively for gaging a part on which it is impossible to use a snap gage because the finished surfaces are not opposite each other. The feeler-pin gages shown in Figs. 2, 3, and 4 were designed to solve some rather unusual gaging problems.

The gage shown in Fig. 2 is used for gaging the depth of the slot cut on the hub of segment gear *S*, as indicated by the dimension 0.250 ± 0.002 inch, and for gaging the 7 1/2-degree angular location of the segment gear. Pushing the arm *P* against the bottom of the slot squares up the work and also gages the depth by means of feeler pin *F*. As the distance *D* increases, the step on the feeler-pin block *B* will also increase. This is, of course, an advantage in gaging the work.

For gaging the angular location, the disk part of

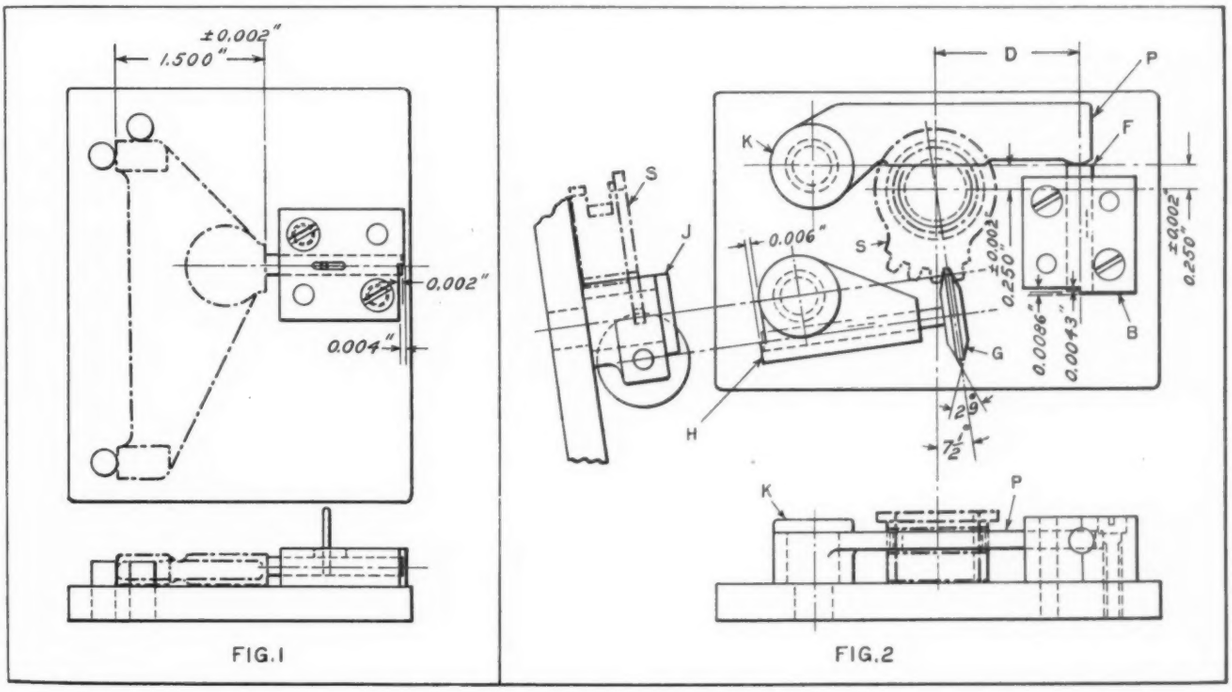


Fig. 1. Feeler-pin Gage Used for Gaging a Part that cannot be Measured with a Snap Gage

Fig. 2. Feeler-pin Gage for Gaging Depth of Slot in Hub of Segment Gear and Relative Position of Gear Teeth

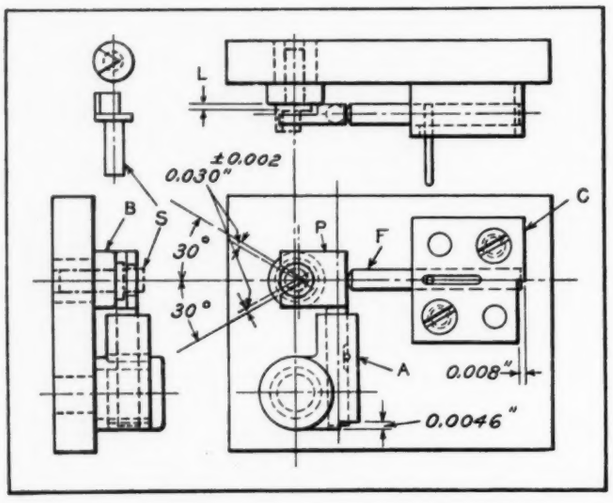


Fig. 3. Gage for Inspecting Angular Faces on Stud S

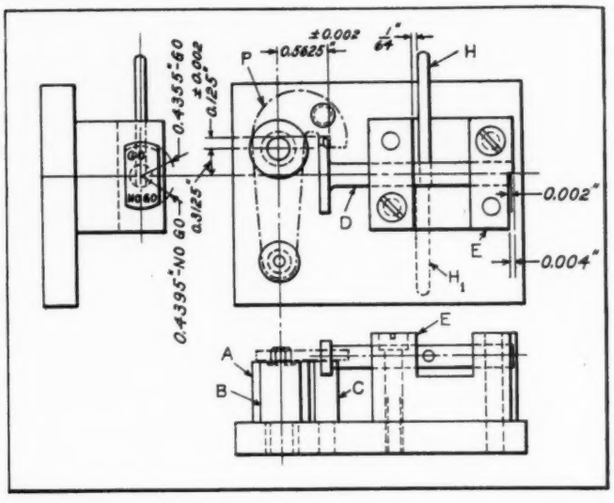


Fig. 4. Gage with Combination Feeler Pin and Limit Gage

the feeler pin G is pushed into the tooth space of the segment gear S as shown. The angular sides of the disk on the feeler pin G, shown by the 29-degree angle, should come in contact with the pitch line of the segment teeth. Any inaccuracy in the angular location of the tooth space is felt at the gaging end of the feeler-pin pawl block H. The center line of the bearing stud J, which serves as a bearing for the block H, must be on a line tangent with the pitch line of the segment gear S. The center line of the bearing stud K should be in line with the bottom of the slot cut in the hub of the segment gear.

The gage shown in Fig. 3 is used for gaging the two cuts on stud S indicated by the dimensions 0.030 ± 0.002 inch, and the 30-degree angles. The stud is placed in bushing B, after which the V-shaped part of the feeler-pawl gaging pin P is moved against the cuts to gage their central location. The feeler pin F is then pushed against pin P to gage the depth of the sides. The length L on the stud S can be gaged with micrometers or a snap gage. While the limits on the cuts are $\pm$ 0.002 inch, the feeler steps on the pawl block A and the block C are increased, as shown, to suit the angle.

The 0.5625 ± 0.002 inch and the 0.125 ± 0.002 inch dimensions on part P, Fig. 4, are gaged by the flush-pin gage illustrated. The part P rests on and is located by studs A and B, and in addition, rests on stud C. The handle H is used for rotating the feeler pin D for gaging the 0.125-inch cut, and is also used for moving the pin D in and out for gaging the 0.5625-inch dimension.

The gage is shown in the "Go" position for gaging the 0.125-inch cut and is also shown in position for gaging the 0.5625-inch dimension by means of the feeler pin D at the step on the block E. For gaging the "Not Go" position for the 0.125-inch cut, the handle H is moved to the left as far as possible, to the position indicated by dotted lines at H_1, so that the gaging disk is rotated approximately 180 degrees. It can be seen that handle H when in position H_1 is in contact with the left inside edge of the block E. This insures having the "Not Go" mandrel portion of the gaging pin D clear the side of the 0.5625-inch cut when gaging the 0.125-inch cut.

Fixture for Boring Main Bearing Saddles

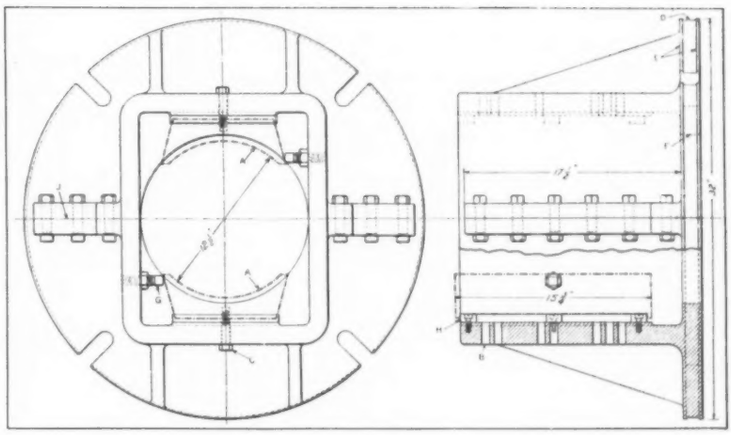
By CHARLES C. TOMNEY, Chief Tool Designer
Carrier Engineering Corporation, Newark, N. J.

The fixture shown in the accompanying illustration is designed for boring the radius-formed surfaces A of two different sizes of main bearing saddles for horizontal compressors. These saddles are also used on steam engine main bearings. It is necessary that they be interchangeable in order to facilitate replacements. The saddles shown in the fixture by heavy dot-and-dash lines are the largest size bored, an adapter (not shown) being provided for the smaller sizes.

The saddles are bored in pairs to facilitate measuring, it being an easy matter to measure the diameter of the bore, which, in the case of the saddle shown, is 12 1/2 inches. The saddles are machined on the bottom, the ends, and the top previous to the boring operation. They are also drilled and tapped, so that they can be held in the fixture by cap-screws, one of which is shown at C in the end view. The cap-screws pass through holes B in the fixture.

The fixture is made of cast iron, and consists of two symmetrical castings made from the same pattern and bolted together at J after being machined. This type of construction facilitates the machining of the fixture in a planer or milling machine. The fixture was made primarily for use in a turret lathe, but it can be set up on an angle-plate and used in a horizontal boring mill.

The turned surface *D* between the protecting flanges *E* provides a means for accurately truing up the fixture in the lathe. The opening *F* was bored true or concentric with the surface *D* to permit using a bushing for piloting the boring-bar. Set-screws *G* are placed as shown to support the work against the cutting strains. Steel strips *H* are bolted and doweled to the body of the fixture for locating the larger saddles. The central strip is made in two parts to allow clearance for the central holding screw. The adapters used in holding the smaller size saddles are secured to each side of the fixture by cap-screws which pass through holes in the adapter. Dowel-pins are provided for locating the adapters in the fixture, so that the adapters can be removed and replaced with the assurance that accurate alignment of the members will be maintained.



Lathe or Boring Mill Fixture for Boring Main Bearing Saddles which can be Fitted with Adapters for Boring Parts of Various Shapes

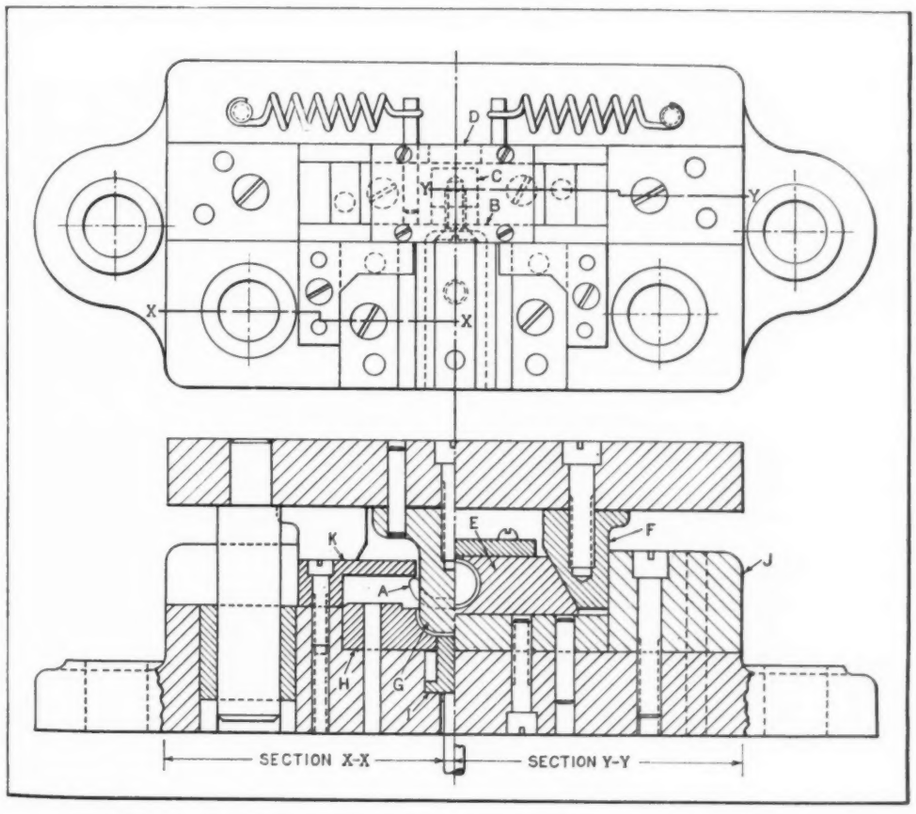
Die for Producing Brass Spacer Bushings from Flat Blanks

By A. E. MOUGEY, Dayton, Ohio

A large quantity of small brass bushings were urgently needed for use as spacers. It was necessary to form these bushings to shape from small flat blanks in a punch press die. The construction of the die designed for this work is shown diagrammatically in the accompanying illustration. This die is of the two-position type—that is, the flat blank is formed to a U-shape at the front of the die on the first stroke, after which it is transferred to the rear of the die where the final closing operation is performed.

The cross-section *X–X* in the lower view shows the left half of the front portion of the punch and die, which forms the flat blank to a U-shape, while the cross-section *Y–Y* shows the right half of the rear portion of the punch and die, which closes the U-shaped blank, thus producing the cylindrical bushing. This die is used on an inclined press. The flat piece is put in the recess in die *H* and the U-shaped blank produced in this position slides through a slot *A* in plate *B* to the final forming position, where it is formed around the arbor *C*.

The finished cylindrical bushing slides out through a hole *D* in the rear plate which retains and guides the final forming slide *E*, actuated by the cam *F*. The forming punch *G* and die *H* which form the work to the U-shape have a spring pad *I* which raises the piece on the return stroke so that it will slide through slot *A* into the final forming position. The block *J* serves to back up and guide the cam *F*. The stripper for punch *G* is shown at *K*.



Two-position Die for Producing Spacer Bushings from Flat Blanks

Clamp for Holding Work in Dies and Fixtures

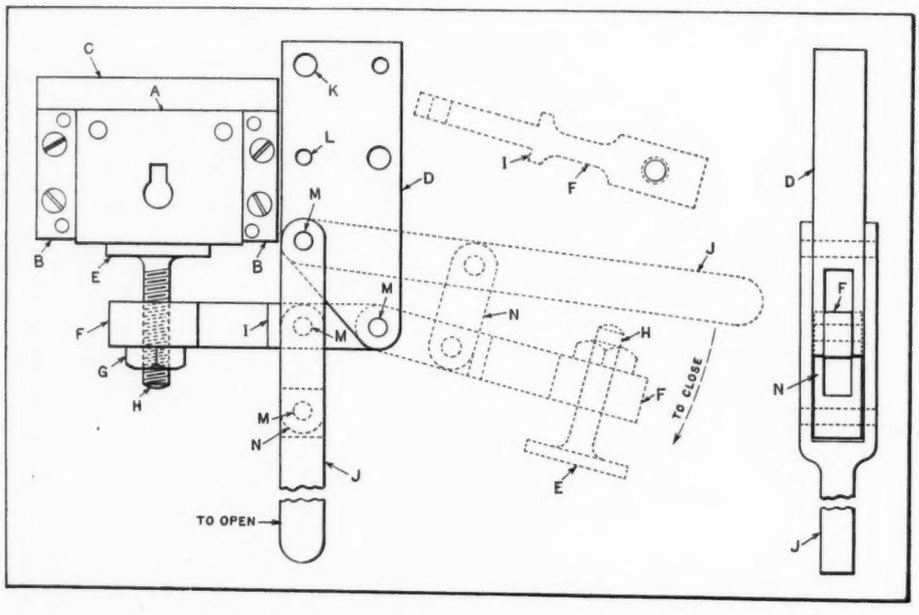
By FRANK J. MAILE, Philadelphia, Pa.

A very effective work-holding clamp for dies, jigs, and fixtures is shown in the accompanying illustration. The principle on which it operates can also be applied in the design of automatic machinery. In the manufacture of pressed-steel products, it is often necessary to provide a clamp such as the one illustrated, which will insure the press operator against injury, as well as hold the work securely in position.

The full-line plan view to the left shows the clamp in its closed position, holding the work *A* on the die-block *C* between the two guide pieces *B*. To open the clamp, the operator swings the handle *J* to the right. The open position of the clamp is indicated by the dotted lines to the right. After the work has been placed on the die-block between the two guides, the clamp is closed by swinging the handle *J* to the left or clockwise.

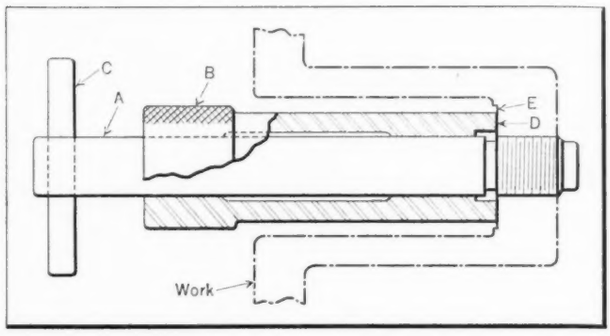
The clamp assembly can be fastened to the jig or fixture in the most convenient position for the operator. It is usually fastened to the die-shoe by two screws *K* and two dowels *L* or by four screws. The parts of the clamp can be made of solid cold-rolled steel, machined to the required shape and size. The fork design of pieces *D*, *J*, and *N* is shown by the view to the extreme right. These fork-shaped pieces may be made by welding or riveting together flat pieces of stock.

The projection *I* on piece *F* acts as a stop for handle *J*, both in closing and opening the clamp. The pad *E* shown on screw *H* may be omitted if desired, according to requirements. Screw *H* provides for adjustment and is locked by nut *G*.



Work-holding Clamp for Use on Dies, Jigs, and Fixtures

Flush rivets are usually employed for the bearing joints *M*. The clamp can, of course, be made any size required to suit different classes of work.



Gage on which Prussian Blue is Used at D to Indicate Squareness of Spot-facing with Tapped Hole

Gage for Checking Squareness of Spot-Facing with Hole

By J. E. FENNO, Belleville, N. J.

The threaded ends of shoulder posts on a certain type of air compressor are assembled tightly in their respective threaded holes. Each tapped hole in the casting is spot-faced to contact with the shoulder on the post. Because of the tight fit of the thread, the spot-facing must be square with the axis of the tapped hole. Owing to the inaccessibility of the spot-facing, difficulty was experienced in determining whether this condition existed until the gage shown in the accompanying illustration was made. It is simply constructed and consists of plug *A*, sleeve *B*, and handle *C*.

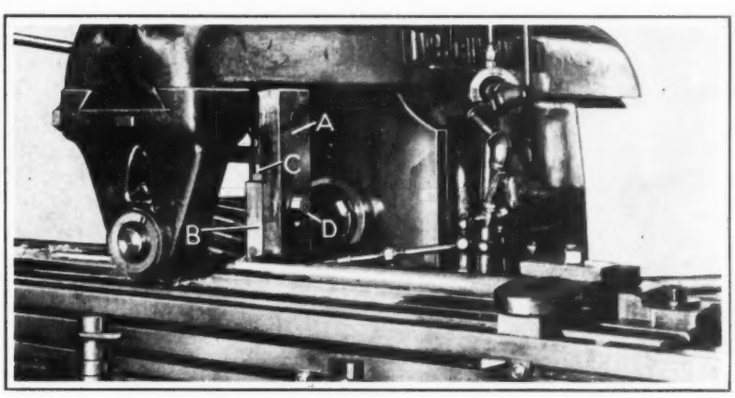
Sleeve *B* is a slip fit on the plug, and the latter is a snug fit in the tapped hole in the casting, which is shown in dot-and-dash outline. In using this gage, end surface *D* of the sleeve is given a light coating of prussian blue. Plug *A* is then screwed by hand into the work, as shown. Now the operator rotates the sleeve and at the same time presses it against the spot-facing *E*. The plug is then unscrewed and the entire gage removed from the work. The operator is now able to observe by the deposit of blue on the spot-facing whether the spot-facing and the axis of the tapped hole are actually square or not.

Simple Set-Up for Milling a Flat on Round Bars

By OLIVER HERBERT

Milling long round bars to make them flat on one side was formerly done at the Battle Creek, Mich., shops of the Grand Trunk Railway System with the bar held on the table by four or five clamps, so as to eliminate all spring. This meant the constant removal or resetting of the clamps as the milling cutter approached them during the cut and, of course, considerable set-up time at the beginning of the operation.

With the method now employed in milling such rods, a clamp is used at the right-hand end only, as illustrated, a stop-block being employed to prevent lengthwise shifting of the rod. This simple arrangement has been made possible by applying a bracket *A* to the over-arm of the milling machine, on each side of the cutter. Each of these brackets is equipped with a block *B*. The block on the right-hand side of the cutter has a roller at the bottom end that bears on the round stock, while the block on the left-hand side rests directly on the flat surface produced by the cutter. Block *B* is adjustable up and down on its bracket, a tongue on the block engaging a groove in the bracket.



The Milling of a Flat on Round Bars is Facilitated by a Device that Exerts Pressure on the Work from Both Sides of the Cutter

When either of these blocks has been positioned by means of its adjusting screw *C* to exert the desired pressure on the rod, stud *D* on the corresponding bracket is tightened to clamp the block in position. The two brackets are tied together by means of a brace that is welded to each. Set-screws *C* enter tapped holes in this brace, their heads resting on the top of blocks *B*. A helical fluted cutter is used for the operation.

* * *

The increase in the use of conveyors has, in many instances, changed shop methods to an almost revolutionary extent. Many small devices are now assembled on benches that move slowly past the operators, thereby timing the various operations. In other instances, conveyor systems carry the parts in baskets past the assemblers, who remove the unit parts and put the finished work back into them to be passed on to the next operation.

Machinery Industries in Scotland Show Improvement

In a report published by the Machinery Division of the Bureau of Foreign and Domestic Commerce, M. L. Davidson of the Glasgow, Scotland, Consular Office states that a considerable improvement has taken place in the marine section of the Scottish industry, largely because of naval work. During 1934, Clyde shipyards received orders for the construction of the machinery and boilers for approximately twenty-five naval vessels.

A notable feature of the year was the increased construction of Diesel engines for ship propulsion. Structural engineers and bridge builders in Scotland also found a reasonable increase in business during the last months of 1934, several contracts having been received from abroad, especially from the British Dominions. One order for fifty steel bridges to China was of particular importance. Locomotive construction was also fairly active during 1934.

The demand for machine tools improved as the year advanced, indicating an improvement throughout the engineering industry as a whole. In spite of keen competition from continental and American manufacturers, Scottish machine tool manufacturers secured an encouraging amount of orders from abroad, notably from Soviet Russia, South America, and the British Dominions. Domestic orders were also satisfactory as a result of the improvement in the shipbuilding industry.

Notable among the machine tool developments was the building of a lathe believed to be one of the longest in the world, which was delivered to Sheffield, England. The bed of this lathe was 143 feet in length, capable of taking a single shaft 110 feet long, but so constructed that two shafts might also be machined in it simultaneously—one 60 feet long and the other 45 feet long, for example.

* * *

The largest single-phase waterwheel generator ever built in this country is being constructed at the Schenectady works of the General Electric Co. for use in connection with the electrification of the Pennsylvania Railroad. It is rated at 35,000 kilovolt-amperes.

Engineering News Flashes

The World Over

Detecting Burglars with Invisible Rays

Recently a photo-electric burglar alarm was installed in a large residence in a western state. An infra-red (invisible light) alarm system was built in as part of the electrical equipment of the building. According to information obtained from the General Electric Co., when the system is set to operate, anyone entering the parts of the building that are protected will intercept one of the invisible light beams, and immediately a relay will operate and sound an alarm at the central burglar-alarm-system headquarters. Since the installation is so arranged that the circuit is normally closed, the alarm will also be sounded if the telephone wires are cut. Another alarm on the top of the building is also sounded which will call any policeman in the vicinity.

World's Longest River Bridge

What is claimed to be the world's longest bridge actually spanning a river is just being completed over the lower Zambesi River in Africa. At the point where the bridge crosses, the river is 11,650 feet wide, considerably more than two miles, making the bridge crossing it the longest river bridge in the world. The whole transportation system in East Africa, it is said, will be greatly influenced by the opening of this bridge, which was built by the Cleveland Bridge & Engineering Co. of Darlington, England.

Early History of Farm Machinery

In an article in the British publication *The Lincolnshire Magazine*, entitled "The Origin of the Threshing Machine," it is mentioned that farm machinery of this type was developed in England some one hundred and fifty years ago. One of the first successful inventors of threshing machinery was Michael Menzies. His machine, driven by a water-wheel, gave "more strokes in a day than forty men and with as much strength." The early inventors made use of mechanically operated flails, but greater success was afterward achieved by revolving drums fitted first with oak pegs and later with metal pegs. By 1810, there were several manufacturers of threshing machines in England. Later, the development of agricultural machinery was largely transplanted to the United States. It is stated that no fewer than 11,000 patents were taken out in this country during the nineteenth century in connection with plows alone.

Grab Bucket with Independent Motor Drive

Independently motor-driven grab buckets ranging in size from 1/2 to 3 cubic yards capacity, for steel mills, foundries, and materials-handling in general, have been developed by the Erie Steel Construction Co., Erie, Pa. The bucket carries its own motor, and hence can be attached directly to any crane or hoisting equipment where electric power is available. A special Westinghouse control makes possible the use of only two conductors between the control cab and the bucket. After the hoist-block hook is slipped into the holding yoke of the bucket and the electrical connection is made by a simple plug device, the bucket is ready to go to work.

Large Roller Bearings for Soviet Steel Mill

In the new Zaporojstal steel mill recently ordered by the Soviet Republics through the Amtorg Trading Corporation from the United Engineering & Foundry Co., approximately 1500 Timken roller bearings, weighing in total about 200 tons, will be used. These bearings will range in weight from one pound apiece up to nearly four tons each. In addition to the roller bearings for the main roll-neck bearings, anti-friction bearings will also be used on the tables and table drives, screwdowns, gear drives, coilers and uncoilers, and pinion stands.

Gigantic Single-Car Shipment

What is said to be the heaviest load ever transported on a single car was recently shipped from the General Electric Works at Schenectady, N. Y., to Benning, D. C. The apparatus shipped was the generator shaft, rotor, and poles for a 25,000-kilowatt frequency converter set weighing 367,000 pounds. There are only six railroad cars in the world capable of carrying this load, the combined weight of the load and the car being 471,300 pounds. Because of the dimensions of the load, the shipment

had to be routed over three different railroads, and in some instances, temporary obstructions and switch stands had to be removed. The entire stretch of road over which the shipment passed was checked for possible obstructions. The dimensions of the load ready for shipment were 17 feet above the rails; for 14 feet above the rails the shipment had a width of 12 1/2 feet. The freight car carrying this load has four two-axle trucks, a carrying capacity of 200 tons, and weighs about 50 tons.

Diesel Engine with Welded Cylinders

Blazing new trails in the construction of Diesel engines, F. B. Stearns of Cleveland, Ohio, recently built an experimental Diesel engine for marine engines with arc-welded cylinders. Since both weight and space are at a premium, arc-welded steel was used both for the cylinders and other parts. The experimental engine is a 320-horsepower type operating at 1300 revolutions per minute. The inner sleeve of each cylinder is of casehardened steel and the outer portions of mild steel, sixteen pieces being welded together for each complete cylinder. In the welding Lincoln welding machines and Fleetweld electrodes were used.

A Huge British Forging Press

What is claimed to be the world's largest electro-hydraulic forging press is a 7000-ton press capable of handling ingots up to 250 tons in weight, which has recently been constructed and installed by the English Steel Corporation, Ltd., at its Vickers Works, in Sheffield, England. The press will be used for heavy forgings of all kinds, including shafts for large electric generating equipment and crankshafts for ships. The electro-hydraulic pumping equipment weighs 400 tons.

Large Roller Bearings for Pumps

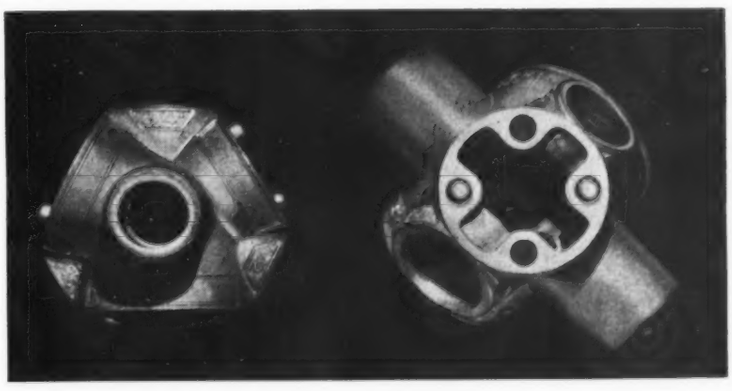
Twenty very large dredge pumps are used in building the world's largest earthen-fill dam across the Missouri River at Fort Peck, Mont. These pumps are provided with the Bantam Ball Bearing Co.'s tapered roller bearings, approximately 24 inches outside diameter, with a radial load-carrying capacity of approximately 500,000 pounds at 100 revolutions per minute. There are two of these bearings to each dredge pump; but, including spares, forty-eight bearings are furnished in all for the equipment.

New Copper-Coating Process

A new process for reducing copper to a form in which it will be especially effective in offering protection against corrosion has been announced by the Nichols Copper Co., Chicago, Ill. The metal, 98.3 per cent pure, is suspended in a liquid vehicle in such a manner that when applied to a surface to be coated, no minute gaps are left, but a virtual armor of copper is provided, which may be put on by spraying or dipping, or with a brush. It is emphasized that this copper coating is not an oxide or bronze powder, but is pure copper in a new form. The new product is expected to find wide use in the marine and electrical fields.

Great Britain Makes Two New Steam-Train Records

The remarkable speed records made on test runs with the new streamline trains in this country, and also in regular passenger service between Berlin and Hamburg in Germany, have stimulated experiments with high-speed train-runs in other countries. From England we learn of a run made between London and Leeds in 2 hours and 32 minutes with a regular steam locomotive pulling four cars. This means an average speed of 74 miles for a distance of 186 miles. On a continuous stretch of 25 miles, an average speed of over 90 miles an hour was maintained. It is claimed that these speeds establish records for steam trains over these distances. At present, the fastest regular scheduled run in the world for the distance covered is made by a Diesel-engine train from Berlin to Hamburg, which covers 178 miles at an average speed of 77.4 miles an hour.



Die-castings Invade the Tool Field. A Three-way Die-head for Pipe Threading Successfully Produced in a Zinc-base Alloy by the Superior Die Casting Co., Cleveland, Ohio. In the Large Holes, Spring-steel Inserts are Cast in Place to Provide for Wear. This is a New Application of Die-castings Made Possible by the Development of a Zinc-base Alloy with Permanent Physical Characteristics.

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

G. R. M.—Have any tables been published that show the relationship between the Brinell hardness numbers and the hardness numbers of the Rockwell scale?

A.—Rockwell-Brinell conversion tables were published in September, 1934, MACHINERY, pages 35 and 36. MACHINERY'S Data Sheet No. 282, published in the same issue, gives the hardness numbers obtained by different tests, including tests made with Brinell, Rockwell, Firth Hardometer, and scleroscope testing equipment.

State Sales Taxes on Machinery

D. K. M.—I am informed that about twenty states have adopted sales tax laws. Please inform me how and under what circumstances a machinery manufacturer is expected to pay the state sales tax.

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

It is well settled that a state cannot compel payment of taxes on interstate business, although it may legally collect taxes on intrastate business. Usually, a transaction is intrastate if any part of the transaction is fully completed within the state. If, however, a seller located in one state sends a representative into another state, and orders taken by such representative are sent to the seller, outside the state, and the machinery is shipped directly from the seller's location, the transaction is interstate, and the state cannot legally collect a tax.

Moreover, an order mailed by a customer in one state to a seller in another state is an interstate transaction, and neither the state in which the customer resides, nor the state in which the seller is located, can collect any taxes.

For illustration, in the leading Supreme Court case of Robbins v. Shelby, 120 U. S. 489, it was disclosed that a salesman from another state stopped at different points within a state to solicit orders. These orders were shipped directly from the foreign state to the customers. Controversy developed over whether the state into which the goods were shipped could legally collect a tax thereon. The Supreme Court of the United States held that the sales actually were not completed until the goods were delivered and accepted by the buyers, and, therefore, such transactions are purely interstate, for which no state tax is collectible.

On the other hand, the law is well established that a seller is transacting intrastate business if he has title to merchandise that is stored in a foreign state, as in a warehouse, and then ships or delivers such machinery to purchasers located within the state in which the machinery is stored. [3 S. W. (2d) 688]

The fact that the salesman collects money when the order is taken does not make an interstate transaction into an intrastate and taxable sale of machinery. (268 U. S. 325) Moreover, delivery at a later date of the merchandise by the salesman does not affect the transaction. (53 So. 741)

On the other hand, the intentions of the buyer and the seller, with respect to title to shipped merchandise, is a most important consideration in determining whether a state may collect a sales tax on merchandise shipped from one state into another. For example, a recent Court held that the state into which merchandise is shipped may tax the merchandise if it is proved that the title to the merchandise did not reside in the purchaser until after it was delivered. This applies when the seller and the purchaser are located in the same state, but the machinery is shipped from a manufacturing plant in another state. (173 Atl. 404)

Air Conditioning Defined

C. S.—Exactly what is meant by air conditioning? This term is commonly used, but few men in the general engineering field seem to know exactly what it means.

Answered by J. F. Sweeny, Jr., Air Conditioning Division, Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

To define the term "air conditioning" in simple language, we might say that air conditioning is a process which warms air when it is too cold; cools it when it is too hot; dampens it when it is too dry; dries it when it is too wet; and cleanses it when it is laden with dirt or dust.

Air-conditioning systems are principally of two different types. For large installations, what the engineers call the "central system" is used. All equipment for this type is located at a central point, from which the conditioned air is distributed through ducts to various parts of the building. The

other type, particularly suited for application in existing buildings and for small businesses, homes, and private offices, is known as the "unit system." With this system, the air is conditioned by small units located in the area where the conditioned air is wanted. These units are not much larger than the average hot-water radiator. The mechanism is enclosed in a casing which is often made to harmonize with the surroundings.

How does air-conditioning equipment work? Omitting technical details and engineering terms, the question may be briefly answered as follows: The air is warmed, as a rule, by passing over steam- or water-heated surfaces; it is cooled by passing over refrigerated surfaces. To dampen it —humidify it—the air is sent through passages where moisture is supplied by sprays. Drying is accomplished by lowering the temperature of the air, thus condensing the moisture. To cleanse the air, either mechanical filters or water-washing is used. Circulation is provided by motor-driven blowers or fans. The unit air conditioner contains within the cabinet all the equipment that will provide proper air conditioning the year around.

Air conditioning today is in the same position that the automobile was when the public ceased to look upon it as a mere novelty and began to see its practical value. In the last few years, air conditioning has proved by numerous installations in stores, restaurants, offices, and factories that air-conditioning equipment is thoroughly practical. Last year the world's largest unit air-conditioning installation was placed in operation in the famous thirty-two-story Tribune Tower in Chicago. Four hundred offices in this ten-year-old building are now air-conditioned.

Fluxes for Babbitting Connecting-Rods

S. T.—What is the best flux to use in babbitting connecting-rods?

Answered by A. Eyles, St. Albans, England

One of the most important factors in the babbitting of connecting-rods is the method of tinning prior to the actual babbitting. It is essential that the bonding between the babbitt metal and the steel be as perfect as possible. The object of the flux is to obtain a chemically clean base metal and to keep it clean, so as to obtain the best possible adhesion of the tinning alloy. It is not sufficient that the surfaces appear to be clean, because a film of oxide quickly forms on a metal surface exposed to the atmosphere, and prevents successful tinning.

There are a great many fluxes used in babbitting operations, some of which are sold under trade names. My experience has proved that the best and most reliable flux to use in tinning forged-steel connecting-rods is zinc chloride. When used as a flux, zinc chloride actually fuses on the surface of the metal as soon as heat is applied, eliminating any oxide that may be present. It also protects the metal surface to be tinned from the oxygen in the atmosphere. This flux is equally suitable for tinning steel or phosphor-bronze connecting-rods.

Zinc-chloride flux is readily made by dissolving pure metallic zinc in strong muriatic acid until the solution will take no more zinc. The acid eats away the zinc, liberating hydrogen during the process. It is important to provide an excess of zinc, so that a quantity remains undissolved after all chemical action ceases. The acid receptacles ought to be placed outside of the shop, so that the fumes will not be inhaled by the workers. After the chemical action has ceased, it is best to allow the flux to stand for a few hours before using. Add no water to this flux, for the stronger it is, the better it will work. If a stock supply of this flux is desirable, it can be made and preserved in large stone jars.

Another tinning flux that gives fairly satisfactory results consists of 60 parts of anhydrous zinc chloride, 39 parts of ammonium chloride, and 1 part of sodium fluoride, ground together and used as a powder. Still another consists of zinc chloride, sal-ammoniac, and metallic tin in powder form.

To prevent the tinning alloy and babbitt metal from adhering to the connecting-rod areas not to be treated, a satisfactory method is to coat these parts with a thin mixture of graphite and water or with a thin clay mixture or wash.

Apply the zinc-chloride flux to the heated connecting-rod areas to be tinned with an asbestos swab, and then immerse the rods into a bath of molten solder. A good solder is one consisting of 67 per cent tin and 33 per cent lead, although an alloy of equal parts of tin and lead is sometimes used. Too much care cannot be taken in fluxing the surfaces to be tinned, in order to secure perfect adhesion of the tinning. If any untinned places are detected on the surface after the tinning process, repeat the operation. The connecting-rods should be left in the molten tinning alloy until there is a thin tin-lead coating over the entire steel surface. Immediate babbitting without intermediate cooling is preferable for good bonding of babbitt metal to steel connecting-rods.

Material for Sheaves

H. S. D.—What material should be employed for sheaves that are subject to the abrasive action of wire rope and foreign materials, as well as impact and shock? This service requires a strong, tough, wear-resisting material.

A.—In a paper read before the American Foundrymen's Association by H. F. Allen of the Link-Belt Co., it was stated that manganese steels serve very well for wire rope sheaves employed for this service, as do also properly heat-treated alloy steels.

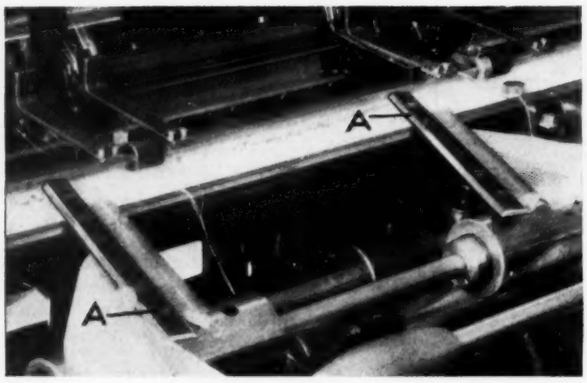


Fig. 1. Twenty-four Transfer Bars A of the Shape Indicated at A, Fig. 6, are Used in this Foot-knitting Machine

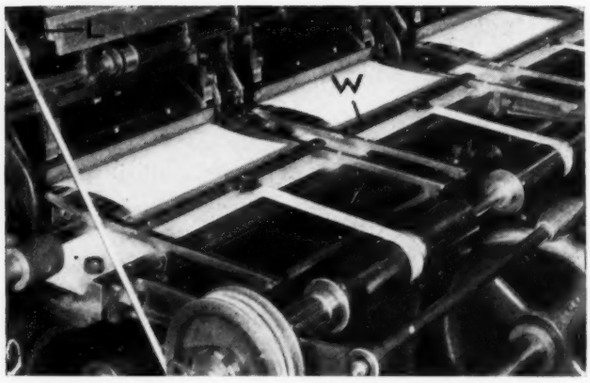


Fig. 2. Welt Bars W and Lock-stitch Bars L are also Made from Cold-drawn Steel of the Shape Shown at A, Fig. 6

Making Machine Parts from Cold-Drawn Steel Sections

Twenty-Eight Special Drawn-Steel Shapes are Used in the Economical Production of Knitting Machine Parts

THE variety of special shapes in which cold-drawn steel bars and rods are now being made is quite remarkable. The practice of making parts by simply cutting this material into pieces of the correct length which require a minimum of machine work, has been found very profitable in many plants and is being adopted as regular practice by a rapidly increasing number of manufacturers.

The use of twenty-eight special drawn-steel shapes by the Textile Machine Works, Reading, Pa., for parts of the Reading full-fashioned knitting machine has proved very successful. Some of these applications are illustrated here to show the possibilities of this method. The cold-drawn steel shape shown at *A*, Fig. 6, is used for transfer members *A*, Fig. 1, and for welt bars *W* and lock-stitch bars *L*, Fig. 2. Twenty-four welt bars *W*, 15 3/4 inches long, and ninety-six lock-stitch bars *L*, 3 1/4 inches long, are required for one machine. Twenty-four transfer bars *A*, Fig. 1, 12 inches long, are also required. Obviously, considerable time and expense are saved in making these parts from cold-drawn material.

Cold-drawn steel stock of the special shape shown at *B*, Fig. 6, is used for clamps for knock-over bits. All dimensions on these parts are held to limits of minus 0.000 and plus 0.003 inch. Another type of clamp is made from special cold-drawn steel stock of the shape shown at *C*, Fig. 6.

What would otherwise be a difficult and costly milling job is economically solved through the use

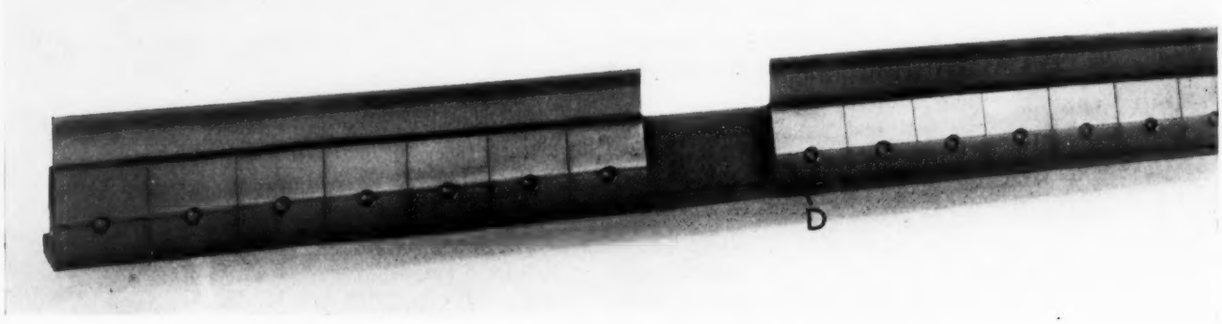


Fig. 3. One Hundred and Sixty-eight Parts D, 2 Inches Long, Cut from Stock D, Fig. 6, are Used on One Machine

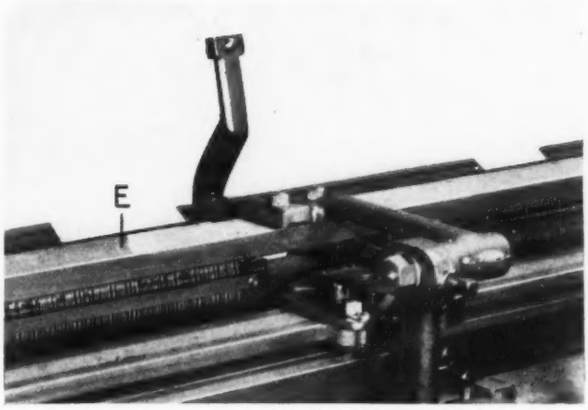


Fig. 4. The Catch-bars E are Cut from Special Cold-drawn Steel Stock Obtained in Lengths Ranging from 8 to 12 1/2 Feet

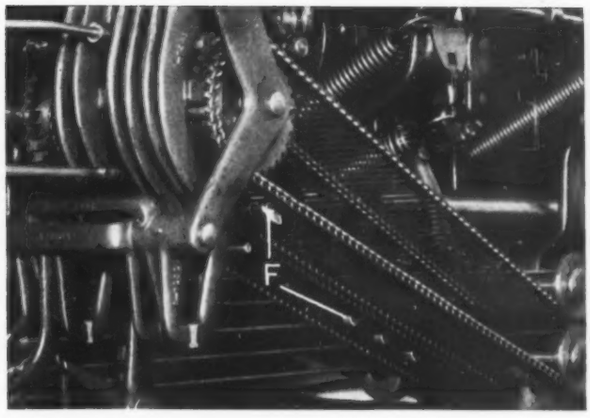


Fig. 5. From 1 to 200 Stops F, Consisting of Two Parts Cut from Cold-drawn Shapes F, Fig. 6, are Required for Each Machine

of cold-drawn steel bars of the shape shown at *D*, Fig. 6. This stock is cut into 2-inch lengths for use in the needle-bar construction shown in Fig. 3. One hundred and sixty-eight of these 2-inch sections *D* are required for each twenty-four section machine.

Cold-drawn steel stock of the shape shown at *E*, Fig. 6, is used for making catch-bars *E*, Fig. 4. This specially shaped stock is purchased in lengths varying from 8 to 12 1/2 feet.

The clamps *G*, Fig. 7, are made from cold-drawn steel stock, cut to the desired lengths and drilled as required. A twenty-four section leg-knitting machine requires forty-eight of these pieces, 1 11/16 inches long, while a twenty-four section foot-knitting machine requires forty-eight pieces 2 1/4 inches long, and forty-eight pieces 1/2 inch long.

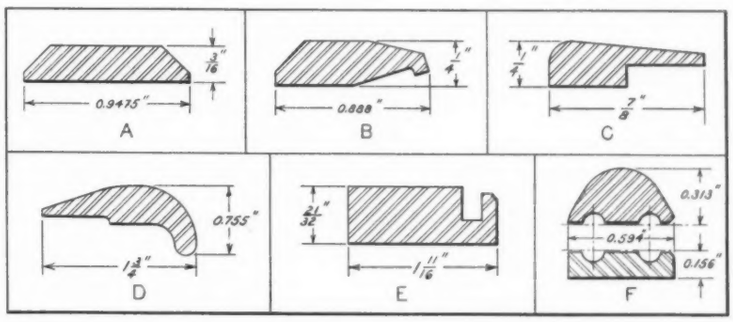


Fig. 6. Cross-sections of Cold-drawn Steel Bars Used for Knitting Machine Parts

The chain stop-blocks shown at *F*, Fig. 5, are constructed in two parts. The two cold-drawn steel shapes from which these stops are made are shown at *F*, Fig. 6. The stock is drilled, tapped, and cut to length by automatic machines. From 1 to 200 complete units made from a pair of these parts are required for each machine. Obviously, the cost of producing these stop-blocks in this way is small, compared with the cost if ordinary machining methods were employed.

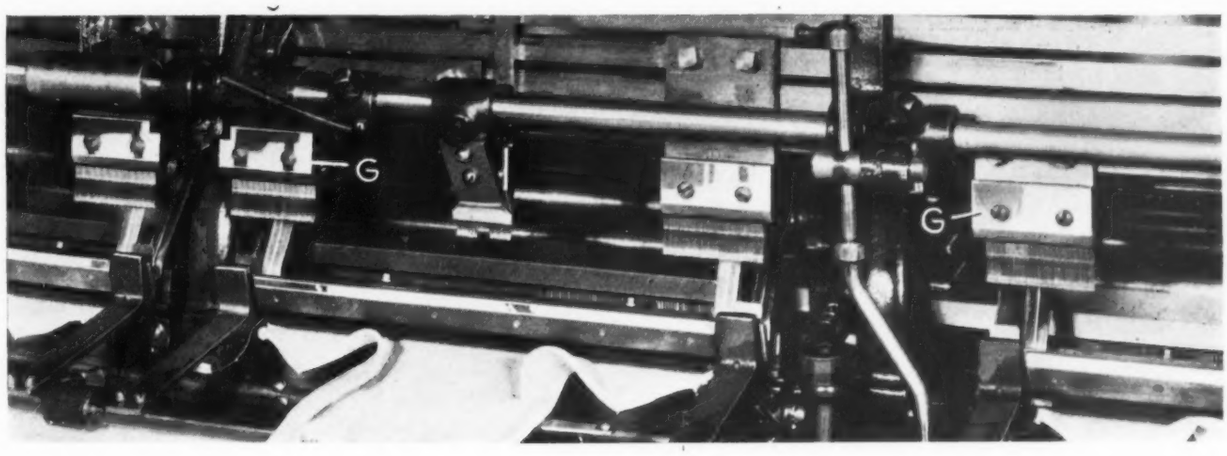
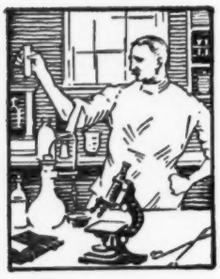


Fig. 7. Forty-eight Pieces G 2 1/4 Inches Long, and Forty-eight Pieces 1/2 Inch Long, are Used on Foot-knitting Machines

MATERIALS OF INDUSTRY



THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

How Nickel Steels are Applied in Automobile Construction

Many of the most widely used alloy steels were developed because of the insistent demands of the automotive industry for materials of superior properties. Even in the advanced stage of development that characterizes this industry today, it continues to provide the incentive for further improvements in the metals that are employed in the manufacture of its products.

Nickel steels play an important part in the performance of today's automobile, as they are used extensively for members that are subjected to high stresses. This will be apparent from the following list, which recently appeared in *Nickel Steel Topics*, a publication of the International Nickel Co., 67 Wall St., New York City. This list itemizes thirty automobile parts and gives the specifications of the steels that are commonly used in making them. In most cases, S A E standard steels are employed.

Part	Steels Used
Steering knuckle and steering arm	S A E 2335, 3130, 3135, 3140
King pin	S A E 2315, 2520, 3115, 4615
Steering ball stud	S A E 2315, 2520, 3115, 3135, 3140
Steering gear arm	S A E 2335, 3130, 3135, 3140
Steering gear and follower	S A E 2315, 2512, 4615
Spring clips	S A E 2335, 3135
Shackle bolts	S A E 2315, 4615
Transmission gears	S A E 2320, 2350, 2512, 3150, 3250, 3440, 4615, 4640
Transmission spline shaft	S A E 2320, 2350, 2512, 3150, 3250, 4615, 4640
Transmission countershaft	S A E 2315, 2512, 4615, 4640
Free-wheeling pineapple	S A E 4820
Free-wheeling spider	S A E 4615, 4820
Propeller shaft	S A E 3130, 3140
Universal joints	S A E 2315, 4615
Rear axle drive shaft	S A E 2340, 3140, 3250, 4340
Rear axle drive gear and pinion	S A E 2315, 2512, 3115, 4615, 4820, X6115
Rear axle differential gears	S A E 2015, 2315, 3115, 4615
Differential cross	S A E 2315, 3115, 4615
Piston struts	32% Ni (low expansion) steel
Connecting-rods	S A E 3135
Connecting-rod bolts	S A E 2330, 2350, 3130, 3140
Piston-pins	S A E 2315, 2512, 3115, 4615
Inlet valves	S A E 3140
Exhaust valves	16 Cr, 14 Ni, (0.60/1.20%C); 8 Cr, 20 Ni, 1 Si, (0.40%C); 21 Cr, 12 Ni, 1 Si, (0.25%C)
Engine bolts and studs	S A E 2330, 3130, 3140
Roller bearings	S A E 4620, 4340

Palladium Leaf Gives a Silvery Luster to Various Materials

The appearance of platinum can be given to various materials, including metal, wood, glass, and plastics, by the application of palladium leaf. The soft silvery luster afforded by this decorative leaf does not tarnish or fade either indoors or outside. In the machinery-building field, one of the possible applications of palladium leaf is for marking company names, etc., on machines.

Palladium leaf is made by the W. H. Kemp Co., 350 Hudson St., New York City. It is beaten between skins in the same way as gold leaf. Palladium leaf is so thin that 250,000 sheets piled on top of each other make a height of only 1 inch. Two thousand sheets, 3 3/8 inches square, weigh only one ounce, and yet they will cover an area of 144 square feet.

Palladium is an element that was segregated from platinum as early as 1803. In the past, it has been mainly used in dentistry, in jewelry-making, and in making important electrical contacts. Its properties as a leaf material have been realized only within the last two or three years.

The Latest Radio Tubes are All-Metal

Radio tubes constructed completely of metal have recently appeared on the market. These tubes are much smaller than the conventional glass tubes, at least 50 per cent smaller in most cases. In addition to the metal tubes being stronger than glass tubes, they can be produced to closer limits. Greater flexibility in design is also afforded. The metallic shell serves the double purpose of a bulb and a shield, thus eliminating the need for the inner and outer shields that are required with most glass tubes.

Resistance welding is employed extensively in assembling the tubes, there being about 4 1/2 inches of vacuum-tight weld on a typical seven-prong tube. Machines built by the Thomson-Gibb Electric Welding Co., Lynn, Mass., are used for this work.

Light-Weight Refractory Concrete Cast on the Job

Light-weight refractory concrete that can be cast on the job has been announced by Johns-Manville, 22 E. 40th St., New York City. This product, known as "L. W. Firecrete," is composed chiefly of a high alumina clay calcined at high temperatures. The resulting concrete weighs only 75 pounds per cubic foot. Under continuous use at a temperature of 2400 degrees F., the shrinkage of the material is so slight as to be negligible. Severe alternate heating and cooling tests have been withstood without spalling.

This material is 40 per cent lighter than firebrick and has 40 per cent lower heat-storage capacity. It is recommended for light-weight refractory shapes and for furnace doors and floors.

Dowmetal Sand-Casting and Wrought Alloys

High tensile strength and improved resistance to corrosion are provided in a new alloy known as Dowmetal H, which has been added to the line of sand-casting alloys produced by the Dow Chemical Co., Midland, Mich. The chemical composition of this alloy is as follows: Aluminum, 5.5 to 6.5 per cent; manganese, 0.18 per cent minimum; zinc, 2.7 to 3.3 per cent; remainder, magnesium.

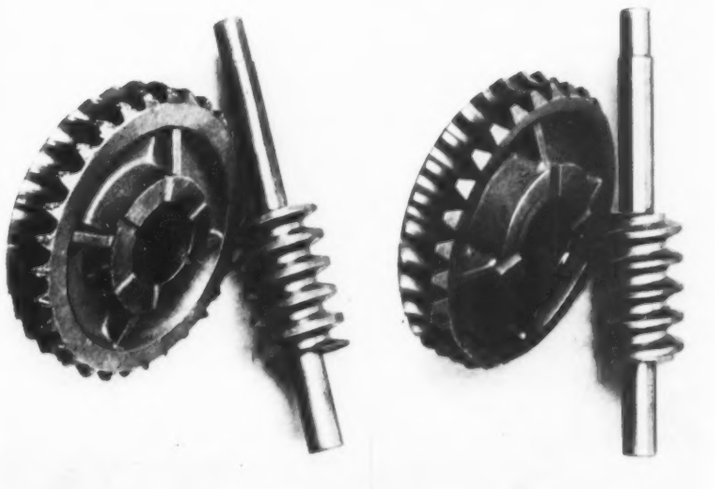
As cast, this alloy has a tensile strength of from 25,000 to 30,000 pounds per square inch; a yield point of from 11,000 to 13,000 pounds per square inch; and a hardness of from 47 to 51 Brinell. With a heat-treatment known as No. 1a, a tensile strength of from 33,000 to 38,000 pounds per square inch, a yield point of from 11,000 to 14,000 pounds per square inch, and a hardness of from 50 to 53 Brinell can be obtained. With heat-treatment No. 3a, a tensile strength of from 37,000 to 42,000 pounds per square inch, a yield point of from 18,000 to 21,000 pounds per square inch, and a hardness of from 65 to 72 Brinell are obtained.

Alloy J has been added to the line of wrought Dowmetal alloys to provide greater elongation, a higher fatigue endurance limit, and improved resistance to corrosion. This alloy is composed of from 6 to 7 per cent aluminum, 0.20 per cent manganese, 0.5 to 1 per cent zinc, and the remainder magnesium. The tensile strength is from 41,000 to 45,000 pounds per square inch, the yield point from 28,000 to 33,000 pounds per square inch, and the hardness from 51 to 58 Brinell. This alloy is obtainable in nearly all extruded shapes and in press forgings.

Dowmetal H has approximately three times the corrosion resistance of alloys A, F, and G when subjected to alternate immersion in 3 per cent salt solution, while alloy J has twice the corrosion resistance of those alloys. Alloys H and J both respond to the chrome-pickle treatment and may afterward be painted the same as other Dowmetal alloys.

Wheels of Colored Plastics Used to Identify Valves

Wheels molded of colored plastic materials are now being supplied on valves manufactured by Jenkins Bros. to distinguish readily between valves on pipe lines conducting steam, water, air or other fluids and gases. Five standard colors—blue, red, black, green, and gray—are regularly used, both unmarked and with five standard service markings molded in relief as, for example, "Water Waste." Wheels can also be supplied with special colors or with special markings. The maker claims that these wheels are cool to the touch, easy to grasp, sanitary, permanent in color, and unusually pleasing in appearance.



The left-hand view shows a worm-gear of manganese bronze (7 1/2 inches pitch diameter) and a hardened and ground steel worm, which were run together ninety-six hours with a load four times the normal amount. The speed of the worm was 350 revolutions per minute. Compare the large amount of wear on the worm-gear teeth with the absence of wear on the nickel cast-iron worm-gear shown at the right, which was run in mesh with a die-cast aluminum-bronze worm (under the same conditions) produced by the Aurora Metal Co., Inc., Aurora, Ill.

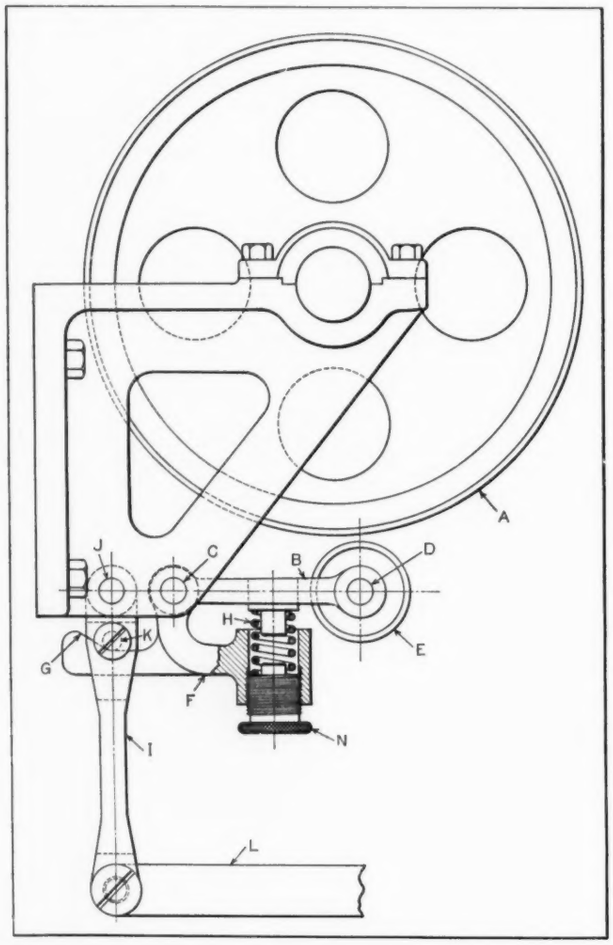
Adjustable Friction Drive

By JOSEPH WAITKUS

A friction drive is generally considered one of the best methods for attaining smooth acceleration and gradual engagement of the driving and driven members of a machine. The friction drive here illustrated permits adjustment of the pressure between the rotating members in order to cover a wide range of service. The drive was originally designed for a spooling machine, but the principle is easily adapted to other purposes.

The entire mechanism is supported by a bracket having two heavy bearings for the main drive shaft, to which the driving wheel *A* is fastened. A small bearing is provided on the bracket for the yoke *B*, which is pivoted on pin *C*. The yoke carries shaft *D*, to which the driven wheel *E* is fastened. A cam-lever *F* is also pivoted on pin *C*.

Lever *F* has a cam *G* at one end, and at the other end, a well for the spring *H*. The pressure of spring *H* against yoke *B* is adjusted by nut *N*. The operating lever *I* is pivoted on the shaft or pin *J*. A pin *K* is fastened in the lever *I* which makes contact with the cam surface *G* on the lever *F*. The opposite end of the lever *I* is connected to the actuating mechanism through the link *L*.



Friction Drive with Sensitive Adjustment for Light Load

The driving and driven wheels are made of the very lightest material and are fastened to their respective shafts by set-screws. The contact surfaces are covered with a layer of rubber composition, which is molded and finished to a smooth surface in order to eliminate jolts or vibration from irregularities.

In operation, the connecting link *L* is set to operate between definite limits. Lever *I* causes the contact pin *K*, riding on the cam surface *G*, to depress lever *F*. This, in turn, causes the opposite end to rise, and through the flexible connection in spring *H*, raises yoke *B*, thus pressing the driven wheel *E* against the drive wheel *A*. Any extra movement of lever *I* after wheels *A* and *E* have made contact is taken up by compression of spring *H*, which increases the pressure of contact between the rotating members.

In the spooling operation, the material varies in size and strength, so that some adjustment is necessary which will permit sufficient slip between the rotating members to offset the possibility of rupture in the material if excessive tension is developed. By adjusting the nut *N*, the pressure between the driving and driven wheels can be varied so that slippage will take place as soon as the driven wheel is retarded, thereby permitting greater flexibility in the drive.

* * *

Improvements in Draftsman's Metal Protractor

By WILLIAM S. ROWELL

Aside from the introduction of celluloid in making draftsmen's instruments, there have been but few improvements in these tools for a long time. Here's a small one: The well-known and highly meritorious draftsman's metal protractor is difficult to pick up from the board and to turn over. This difficulty can be easily remedied by filing two pairs of 45-degree bevels in the protractor like those on most triangles.

One pair of bevels should be filed at the end of the blade, each one of this pair occupying one half the width of the blade and extending to within about 1/32 inch of the opposite side. The other pair should be filed at the center of the left-hand edge of the head. These bevels should be about 1/2 inch wide and be cut the same, front and back, leaving about 1/64 inch of the original straightedge between them. This leaves the edge unbroken, so that it can be used as a straightedge for a pencil.

The blade often shifts easily in the head, and thus carefully made settings are lost. This is easily overcome by burnishing down, at two or more points, the metal of the head that overhangs the blade tongue until the desired tension is secured.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Cutting Oils

SOCONY-VACUUM OIL CO., INC., 26 Broadway, New York City. Pamphlet entitled "Facts about Metal Cutting, Stamping, and Drawing," containing much useful information about the proper coolants to be used on various materials and operations. The pamphlet contains data regarding the results obtained with various Socony-Vacuum cutting and soluble oils on different classes of work, as compared with other oils. The materials covered are: Cold-rolled steel, mild steel, sheet steel, strip steel, United States Navy-Army plate, various S A E steels, high-carbon steel, tool steel, stainless steel, high-speed steel, nickel steel, oil steels, gun barrels, rifle barrels, cast iron, malleable iron, pipe, aluminum alloy, bronze, Anaco bronze, Monel metal, and nickel silver. In the case of the S A E steels listed, the chemical composition is included in the data.

Roller Bearings

TIMKEN ROLLER BEARING CO., Canton, Ohio. Third edition of the Timken Engineering Journal, compiled for the use of engineers and machine designers. This publication contains 260 pages bound in a heavy loose-leaf binder. The first four sections cover the design of Timken bearings, including a discussion of how they are rated; speed rating curves and speed factors; calculation of loads; and bearing selection. There are fifty pages of tables giving dimensions and price lists of the various sizes and types of bearings. This section is followed by detailed dimension sheets, and full and half-size illustrations suitable for tracing are given for all single-row bearings. Among the other information included are bearing ratings for different speeds; methods of mounting Timken bearings; cup and cone fitting practice; and lubrication.

Electric Equipment

GENERAL ELECTRIC CO., Schenectady, N. Y. Catalogue GEA-1839, entitled "Cable Accessories," containing data that should be of interest and aid to anyone engaged in work that involves the jointing and terminating of insulated cable. This book is a companion book to the publication entitled "How to Make Cable Joints," previously issued. Bulletin GEA-2127, entitled "End Troublesome Maintenance with These G-E Knife Switches," giving complete dimensions for the two types in which these switches are made.

Power Transmission Equipment

GRATON & KNIGHT CO., Worcester, Mass. Publication containing a study of the application of power to work, with particular reference to the economics of the two generally used systems — individual motor drive and group drive. The proper application of both group and unit drives is discussed, and the importance of the selection of the proper belt to give the best efficiency to the correct drive is emphasized. Charts and tables are included of use in figuring the power transmission requirements of any particular machine.

Ball Bearings

NEW DEPARTURE MFG. CO., Bristol, Conn. Tenth edition of the New Departure ball bearing catalogue, covering the full line of New Departure ball bearings. In addition to listing all the new bearing types and sizes, the book contains much information of value to engineers and designers, such as tolerances and mounting fits for standard, precision, and ultra-precision bearings; bearing closure data; and methods of selecting bearings.

Compressors

INGERSOLL-RAND CO., 11 Broadway, New York City. Catalogue 3344, illustrating and describing Ingersoll-Rand Type XPV steam-driven compressors, which are made in a wide range of sizes from about 50 to 1500 horsepower. A table of compressor sizes and capacities is given, and there are many illustrations showing various applications of these compressors.

Cold-Drawn Steel

UNION DRAWN STEEL CO., Massillon, Ohio. Bulletin entitled "The Most Highly Refined Steel Bars for Use as Raw Material," calling attention to the accuracy obtainable in cold-drawn steel bars. The circular contains sketches showing graphically the advantages of the cold-drawing process as applied to bars, flats and squares, and special shapes.

Mechanical Rubber Goods

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., 34 Townsend St., Passaic, N. J. General catalogue containing fifty-six pages covering this company's complete line of rubber products for industrial use, including various lines of belting, hose, fittings, packing, friction material, etc. Engineering data of value to designers are included.

Arc-Welded Rolled-Steel Construction

WHITEHEAD & KALES, Detroit, Mich. Catalogue outlining the advantages of the use of arc-welded rolled-steel construction in the building of machines. An idea of the possibilities of this method will be obtained from the many illustrations of machine units constructed in this way.

Steels

TIMKEN STEEL & TUBE CO., Canton, Ohio. Sheet listing Timken revised steel specifications. In addition to listing the alloy and carbon steels under S A E classifications, specifications are also given for Krupp Ni-Cr-V and the special corrosion- and heat-resisting steels produced by the company.

Tools

FORSBERG MFG. CO., Bridgeport, Conn. Catalogue showing recent additions to the Forsberg line of "Whale" and "Viking" tools, including milling cutters, hacksaw blades, hacksaw frames, coping saws, and screwdrivers. Several new tungsten and molybdenum tools are shown.

Chain and Belt Conveyors

CHAIN BELT CO., Milwaukee, Wis. Catalogue containing a large number of illustrations showing applications in different industries of the various types of material-handling equipment made by this concern. The views shown indicate the wide scope of conveyors in all industries.

Industrial Furnace Equipment

W. S. ROCKWELL CO., 50 Church St., New York City. Catalogue 351, listing the advantages and giving dimensions, weights, etc., of the Rockwell air-tight blast gates for controlling the flow of air for industrial furnaces and other equipment involving the control of air.

Pumps

WORTHINGTON PUMP & MACHINERY CORPORATION, Harrison, N. J. Bulletins W-102-B1 and W-321-B2A, describing, respectively, Worthington horizontal duplex piston pumps for general services, and Worthington small-size single-stage Monobloc centrifugal pumps.

Ball-Bearing Centers

READY TOOL CO., 550 Iranistan Ave., Bridgeport, Conn. Folder descriptive of the Red-E New Departure ball-bearing centers, which are made in both the shank type and the outside-of-spindle type. Complete specifications, including prices, are given.

Compression Pipe Coupling

S. R. DRESSER MFG. CO., Bradford, Pa. Leaflet descriptive of the new Dresser Style 65 compression coupling for joining pipes. The circular describes the advantages of this new type of coupling and its applications, and gives a list of available sizes.

Electric Furnaces

HEVI DUTY ELECTRIC CO., Milwaukee, Wis. Bulletin HD 535, illustrating and describing this company's standard line of electric multiple-unit muffle furnaces suitable for heating metals and alloys, enameling, heat-treating, and experimental test work.

Turret Lathes

WARNER & SWASEY CO., Cleveland, Ohio. Circular 3501, illustrating and describing in detail the various features of the Warner & Swasey No. 4 universal turret lathe with twelve-speed all-geared head. Complete specifications are included.

Shakers

AJAX FLEXIBLE COUPLING CO., 12 English St., Westfield, N. Y. Bulletin descriptive of the Shaler Shaker, which is designed to be mounted directly on a screen, sieve, conveyor spout, or other device, to produce an oscillating movement.

Electroplating Equipment

U. S. GALVANIZING & PLATING EQUIPMENT CORPORATION, INC., 27 Heyward St., Brooklyn, N. Y. Catalogue showing typical installations of mechanical and automatic electroplating equipment, cleaning apparatus, dryers, etc.

Oil Seals

CHICAGO RAWHIDE MFG. CO., Chicago, Ill. Bulletin on the application of oil seals, describing where these seals should be used and why. The illustrations show how oil seals are applied on various classes of machinery.

Mercury Vapor Lamps

GENERAL ELECTRIC VAPOR LAMP CO., 893 Adams St., Hoboken, N. J., is distributing a calendar—June, 1935, to May, 1936—on each sheet of which is shown an installation of mercury vapor lamps in industrial plants.

Chain Hoists and Trolleys

HARRINGTON CO., 17th and Callowhill Sts., Philadelphia, Pa. Loose-leaf catalogue covering the Harrington line of Peerless hoists, screw hoists, differential hoists, trolley hoists, electric hoists, trolleys, and cranes.

Test-Lights and Fuse-Pullers

IDEAL COMMUTATOR DRESSER CO., Sycamore, Ill. Circular covering this company's new combination test-light and fuse-puller with flexible leads, for testing electrical circuits and removing or replacing fuses.

Abrasives

GENERAL ABRASIVE CO., 3409 Hyde Park Blvd., Niagara Falls, N. Y. Revised edition of a booklet entitled "Modern Polishing," containing much information of value to those engaged in polishing operations.

Lubricating Systems

BOWEN PRODUCTS CORPORATION, Auburn, N. Y. Catalogue AF-73, containing information on Bowen industrial "one-shot" lubricating systems, including data on the operation and installation.

Welding Hoods

E. D. BULLARD CO., 275 Eighth St., San Francisco, Calif. Circular descriptive of the Walker welding hood designed to protect the head and eyes of men engaged in performing welding operations.

Belt Conveyors

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill. Folder 1414, covering the Link-Belt line of portable belt conveyors for industrial plants, building supply yards, contractors, etc.

Aluminum Pistons

ALUMINUM COMPANY OF AMERICA, Pittsburgh, Pa. Circular describing the exclusive features of Lynite T-slot pistons, and the advantages of this type of construction.

Speed Lathes

SCHAUER MACHINE CO., Cincinnati, Ohio. Circular 351, descriptive of the Ideal line of motor-driven speed lathes, designed for finishing, polishing, or lapping small parts.

Dowmetal

DOW CHEMICAL CO., Midland, Mich. Supplement to the Dowmetal Data Book, containing information on the surface treatment and painting of Dowmetal.

Diamond Dressing Tools

KOEBEL DIAMOND TOOL CO., 1200 Oakman Blvd., Detroit, Mich. Circular outlining the advantages of the Koebel diamond dressing tools.

Electric Motors

LOUIS ALLIS CO., Milwaukee, Wis. Bulletin 601, dealing with the special characteristics of electric motors for centrifugal drives.

Is Written-Off Machinery an Asset or a Liability?

Possible Taxation of Corporate Surpluses and Recent Treasury Rulings Covering Depreciation Allowances Make the Old Written-Off Machinery in the Plant a Factor that Requires Consideration

By L. D. McDONALD, Assistant Treasurer
The Warner & Swasey Co., Cleveland, Ohio

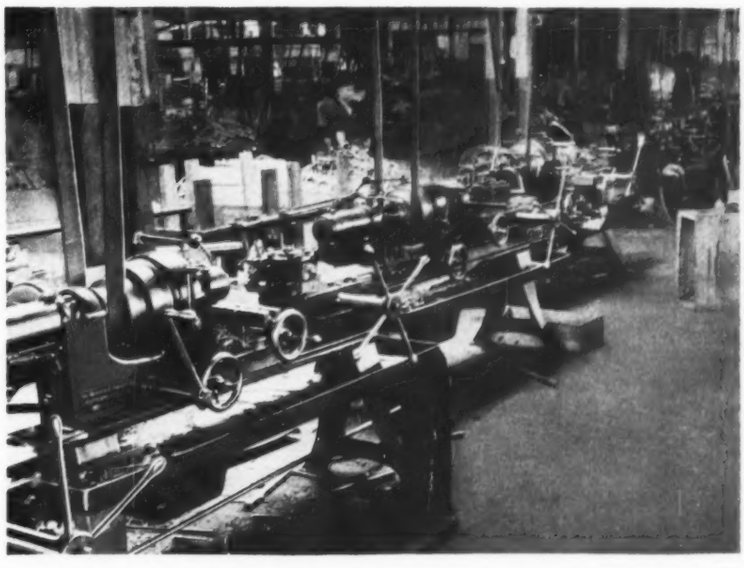
THE question raised in this article is not merely a subject for academic discussion, but is one that, in the near future, may possess a significance of utmost importance. There have been rumblings in Washington which seem to indicate that the Government is considering the taxation of corporate surpluses. The Government feels that these surpluses should be disbursed in dividends on which a tax could be collected from the investor, and as long as they are retained by the corporation earning them, they are not now taxable.

The corporate surplus is built up to weather the corporation over lean times and also to justify expansions in plant and to provide working capital. When a corporation is formed, the stockholders invest a certain amount, a goodly portion of which is immediately put into fixed assets in the form of plant and equipment; the remainder goes into working capital. This working capital fund is then increased by corporate earnings and decreased by dividends disbursed to the investors in the business.

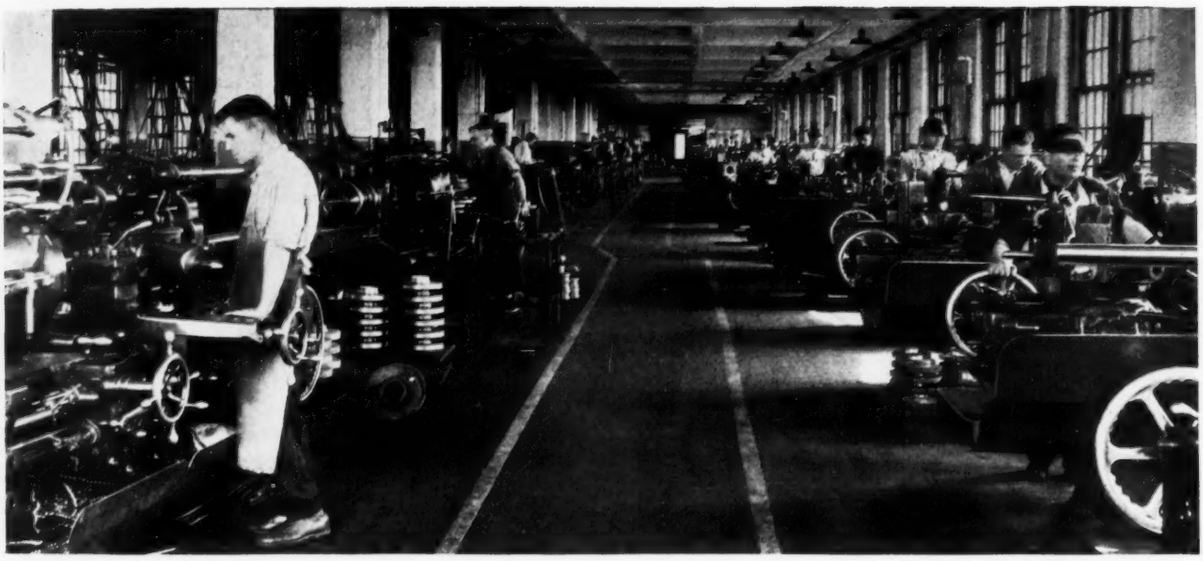
The investment in plant and equipment is depreciated over a period of years which is supposed to represent the life of the assets for the purpose for which they were purchased. This depreciation is included in the cost of the goods manufactured and sold, so that when the selling price of these goods has been collected, it is represented by cash.

Theoretically, the proper procedure would be to set aside the amount of cash represented by the return of depreciation, for the replacement of the plant and equipment when its normal life has been accomplished. It should not be a part of the corporation's working funds, because it was invested for the purpose of providing manufacturing facilities in the first place.

Unfortunately for the capital goods industry of the country, very few concerns follow this policy, and the funds accumulated through the write-off of the capital investment are returned to the stockholders in dividends. If the dividend policy is a liberal one, the corporation may find itself some



It is a Question whether Machine Tools of This Type will be an Asset or a Liability Under the New Treasury Rulings



Thousands of Plants throughout the Country can Profitably Modernize their Machine Tool Equipment

day in the position of "killing the goose that laid the golden egg," because competition dictates that business shall go to the lowest-cost producer; and with the developments in modern equipment that have taken place in the last few years, very few corporations can afford to be operating equipment which has outlived its normal life.

If a corporation has maintained a conservative dividend policy, this return of depreciation has tended to build up its cash balances, and the large cash balance, together with a fat surplus account, might be interpreted by the Government as almost prima facie evidence that the surplus had been accumulated improperly, and that a large proportion of it should have been disbursed to the stockholders in the form of dividends.

If, however, a corporation follows the proper procedure of replacing its plant facilities when they reach the end of their normal life, undue accumulation of cash through the recovery of the original cost of the plant facilities does not occur, and the plant is maintained on a highly productive basis, fit to compete in the present markets.

Do Stockholders Want their Investments to be Permanently Profitable?

It would seem to be the old predominant investment question all over again: Do the stockholders invest their funds in a corporation in order to secure income or do they merely lend their funds to the corporation to be returned to them in a comparatively short number of years? In the first case, no better policy for insuring the continuance of a proper income from the investment could be adopted than that of replacing plant and equipment as promptly as its normal life is accomplished, or as it is obsoleted by advancements in machine design or methods. In the second case, unless the corporation is highly successful, the stockholders must expect a smaller return in the years after their investment has been fully returned to them, and must look forward eventually to having some pieces of mere paper in their hands.

It would seem that from the standpoint both of preserving the investment of the stockholder and of avoiding a federal tax, which might possibly amount to 50 per cent for the improper accumulation of surplus, a policy should be adopted by which the funds accumulated through the recovery of the original investment in plant and equipment should be reinvested in new facilities as rapidly as the normal life of these facilities is accomplished. The operation of plant facilities which have been fully depreciated represents not only the possible hazard from surplus taxes, but also may cause increased income taxes, because of the disallowance of depreciation on other plant facilities.

The Government's Point of View Cannot be Ignored

Naturally the Government, actuated by a desire for more taxes, will disallow what is considered unfair depreciation allowances, and in such disallowance will attempt to permit only such depreciation as will return to the manufacturer the cost of his equipment and plant facilities over a period that will closely approximate the physical life of the asset, if it is possible to do so. By such disallowance, the Government will be enabled to collect more taxes on corporate incomes. The public was

given notice of the intention of the Government to collect these additional taxes in a recent well-known treasury decision. (No. TD-4422)

Entirely aside from consideration of purposes, there is, from the Government standpoint, some reason for this attitude. As long as machinery is used for actual productive purposes, it is presumed to be profitably used, and if profitably used after its entire value has been written off through depreciation allowances, such allowances might quite properly be considered improper. Heretofore, the Government has had to prove that the depreciation deductions made were improper, but in decision "TD-4422" the burden of proof that the depreciation deduction is proper is put squarely upon the shoulders of the taxpayer; therefore, many manufacturers are faced with the problem of setting up detailed plant ledgers, and in doing so, may find that a large portion of their plant facilities have been fully depreciated, but are still in use. It will be very difficult to substantiate a reasonable depreciation deduction under current operations on the remainder of the facilities that have not been written off, because those portions of the plant investment that are still in productive use, but have been fully depreciated, are prima facie evidence that the rates of depreciation used in their write-off were improper. The Government can quite properly claim that the rate of depreciation used in current operations is too high.

When Old Machinery Becomes a Liability Instead of an Asset

When you consider that the Treasury Department expects to secure additional taxes of many millions of dollars through the disallowance of depreciation, and realize that the tax collected is only 13 3/4 per cent of the amount of depreciation thrown out, you will realize the importance this question of operating obsolete and completely depreciated machines may assume to every manufacturer. In face of these conditions, it is obvious that old machines, the original cost of which has been fully or largely written off, though still capable of a fair degree of operating efficiency, become *a liability rather than an asset.*

In view of this, the manufacturer must give thought to these questions:

1. How can cash accumulated from the recovery of cost of facilities be best utilized?
2. How much money, from an operating point of view, will it take to put plant and equipment into such shape as will safeguard the stockholders' investment and justify the accumulation of cash and surplus for this purpose?
3. How can the company be protected against possible disallowance of its depreciation schedules?

These questions cannot be answered by generalizations. Write-off allowances and replacement requirements are problems for individual study with respect to each facility, in the light of work to be performed, and the rate of productivity expected of the plant. Take machine tools as a typical illustration. Few machine tools are utterly worn out and incapacitated for service at the end of their estimated normal life. On the other hand, there are any number of machine tools now in use in the country's factories which are quite serviceable, for some purposes, and yet from a productive standpoint have been rendered utterly obsolete by reason of new developments in the machine tool industry.

For example, new cutting tools, high speeds, and improvements that make today's turret lathes capable of removing on the average about twice as much metal as was possible by old models have made obsolete a large share of the equipment now in use. And yet, in making this very statement, I must qualify it. New machine tools render old machine tools obsolete, in many cases, only if and when a high rate of productivity is essential. For instance, consider a machine tool that, after some years of service, is now operated upon a 50 per cent activity basis. If operations continue upon this basis, the machine may be good for five years more; but if operations step up to a 100 per cent basis, it is questionable whether this five-year life will be realized.

Consider another illustration. Take the case of a machine that is capable of turning out 200 parts in eight hours. On a two-shift basis, the machine may turn out 400 parts in sixteen hours. If 400 parts is the maximum productivity that the plant expects, the machine, although somewhat old, may continue to justify its existence. But suppose the desired productivity jumps to 700 a day, and that there is available a new model that is capable of turning out 1000 parts in sixteen hours. Then it takes no mathematician to realize that the *desired* productivity has, under the circumstances, rendered the old machine obsolete.

A Recent Experience in a Large Manufacturing Plant

Here is another situation, excellently illustrated by the recent experience of a large manufacturer. This company was operating a battery of twenty-five turret lathes. The lathes had been in operation for a number of years, and apparently, in the opinion of the company, were giving satisfactory performance. In all probability, they had been written off to a considerable extent on the books of the company, but still stood on the books as being of some value.

A survey by our company, however, disclosed the fact that twelve new turret lathes of the modern increased productivity type could do the same job as the twenty-five old lathes at a reduction of 50 per cent in cost of operation. In fact, the new turret lathes would pay for themselves in twenty-seven months. The new lathes were installed immediately.

The point is that even in the case of machine tools apparently operating satisfactorily, when a survey reveals such a degree of obsolescence, the machines should immediately be written off the books, discarded, and replaced. As long as they continue in operation, they remain actually a liability.

Now consider the converse of such a situation. Take a plant that has a battery of machine tools twelve years old which are used for one particular purpose and no other. They are not now used to capacity, and there is little expectation of their ever being used to capacity. They are capable of turning out the work laid out for them without excessive cost at the present time, and apparently will be able to turn out such work within such limitations for five years more. If no increased production is expected of these machines, if labor costs are not exorbitant, and if these machines have already been completely written off the books, there remains a reasonable justification, from the standpoint of shop practice alone, for continuing them in operation. But if they are thus continued in operation, the company that operates them may probably expect an argument with the Treasury Department with respect to depreciation—possibly with regard to its entire productive equipment.

How the Machine Tool Builder's Experience May be Used

In solving the problem of the most efficient use of cash accumulated from recovery of cost of facilities, estimating amount of money required to rehabilitate plant and equipment, and protecting the company against possible disallowance of depreciation schedules, the machine tool manufacturer may be of particular service. It is part and parcel of the machine tool builder's job to estimate operating costs and productive life of machines with respect to the jobs they are expected to perform, not in terms of generalizations, but in terms of specific machines and specific operations.

Many years of practical experience, plus the technical knowledge necessitated by the industry, have enabled the machine tool manufacturer to build up and perfect sound methods of arriving at accurate cost and operating figures. Naturally, the machine tool builder is not altogether altruistic in offering such services to the manufacturer. In so doing, he hopes and expects to sell more machine tools—for his slide-rule may uncover hitherto unexpected needs for replacement. At the same time, the service of the machine tool builder with respect to cost calculations having a bearing on depreciation, obsolescence, and taxation may prove of utmost value to a manufacturer who must make a decision between increased taxes, or expenditures for replacements.

To summarize, let us go back to the original illustration of a corporation in the process of formation. A certain sum of money is set aside for plant and equipment, and a certain sum of money for working capital. As the investment in plant and equipment is recovered through depreciation, it should be reinvested in replacing the worn-out facilities, and not become part of the working capital from which it was originally segregated. The machine tool builder should be consulted on this problem, just as he was consulted when the original funds for plant facilities were first invested.

Furthermore, if a policy of replacing worn-out facilities when their normal life has been accomplished is not followed, and the funds are not disbursed in dividends, there is considerable possibility that within the next few years a large portion of them may be appropriated in the way of taxes on surplus. Besides this, additional income taxes may be assessed because of the disallowance of what is considered by the management a conservative depreciation deduction, because of the operation of fully written-off equipment beyond its estimated normal life.

When the burden of proof is on the taxpayer—as we are warned it will be from now on—proof of depreciation and obsolescence, even though accompanied by recommendations for replacement of machine tools, may be welcome.

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Survey of the World's Welding Literature

The Engineering Foundation has appointed a welding research committee to initiate and conduct a critical review of world welding literature; to render aid to projects functioning under the fundamental research committee of the American Bureau of Welding; and to sponsor specific research investigations. The project will be started by funds contributed by the Engineering Foundation, supplemented by funds and services supplied by industry. It is jointly sponsored by the American Institute of Electrical Engineers and the American Welding Society. Further information can be obtained from William Spraragan, secretary of the Welding Research Committee, American Welding Society, 33 W. 39th St., New York City.

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Permanent Exhibit of Metals and Plastics

On September 1 a permanent exhibit of metals and plastics will be opened at Rockefeller Center, New York City, by Metal Products Exhibits, Inc. The exhibition will be of interest to executives, engineers, designers, production managers and buyers of materials and parts for industrial purposes. It will feature alloys, ferrous and non-ferrous metals, plastics, finished and semi-finished parts made from these materials, finishes for metals and plastics, manufacturing processes, designs, styling, etc. The exhibit will occupy the third floor of the International Building.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts and Material-Handling Appliances Recently Placed on the Market

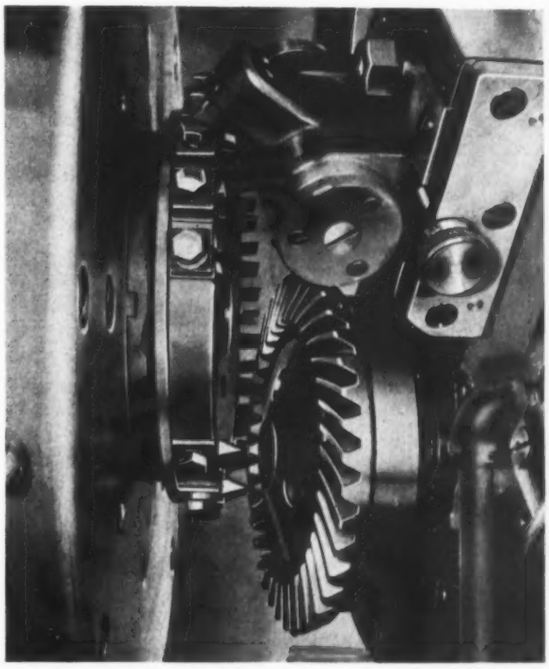


Fig. 2. The Finishing Cutter is Made with Two Series of Inserted Blades

Gleason Single-Cycle Gear-Finishing Machine

As the Gleason Works, 1000 University Ave., Rochester, N.Y., enters its seventieth year of service to the metal-working industry, most of which has been devoted to the manufacture of straight- and spiral-bevel and hypoid gear-processing equipment, it announces another important development of particular interest to the manufacturers of automotive equipment. This development consists of a new production machine, which, according to the manufacturer, employs the fastest method yet devised for finish-cutting spiral-bevel and hypoid ring gears. The machine is known as the No. 11 single-cycle gear-finishing machine.

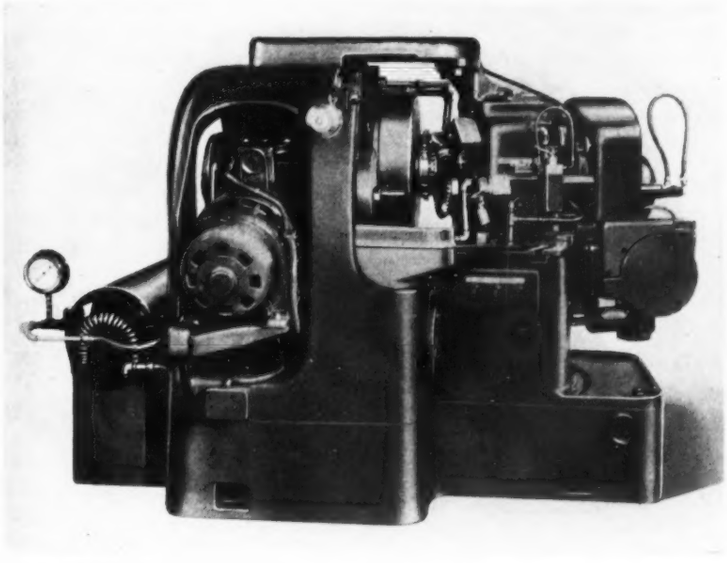


Fig. 1. Gleason Single-cycle Gear-Finishing Machine which Finishes a Gear Tooth at Each Revolution of the Cutter

The gear to be finish-cut is previously rough-cut in a standard Gleason rougher. The face-mill finishing cutter has two series of inserted blades. The blades of the first series are made of progressive depth, so as to accurately shape and space each tooth by a succession of very light cuts. The blades of the second series cut to the full depth, thus finally sizing the tooth and producing the desired smoothness of finish and accuracy of spacing. Only one revolution of the cutter is required to finish one tooth.

The cutter and gear remain in the normal full-depth operating position during the entire machine cycle. A gap between the two series of blades on the cut-

ter provides for indexing. When this gap comes abreast of the gear blank, the latter is indexed. The cutter rotates at a uniform speed. Owing to the very light cuts taken by each blade, the cutter has an unusually long life and only a comparatively small amount of metal need be ground off the blades to renew their cutting edge. Sharpening is performed on a standard Gleason sharpener.

In addition to the fact that only one cutter revolution is required for finishing each gear tooth and that indexing of the gear blank is effected without loss of time, an important advantage of the new machine is that the slow-turning cutter-spindle is the only part in operation during cutting. The cutter seating surfaces are ground with the spindle mounted in its own bearings. Accuracy of tooth spacing is insured by a hardened and ground index-plate, mounted directly on the work-spindle.

Chucking and unchucking of the work have been greatly facilitated by means of a power mechanism which is built into the work-spindle and controlled by a convenient lever. When this lever is operated, the gear is clamped to the arbor, the work-head is advanced to the cutting position, and the work-head is clamped.

The automatic features of the machine are fully protected by safety devices. An automatic device stops the machine when the last tooth of a gear is cut, thus eliminating any possibility of recutting. This stop resets itself for each gear. The hydraulic unit provided for this machine develops a pressure of 600 pounds per square inch. The unit is driven by a two-horsepower motor. A three-horsepower motor drives the cutter.

Landis Plain Hydraulic Grinding Machines

Plain hydraulic grinders in 10-, 14-, and 16-inch sizes, designated as Type D, have been placed on the market by the Landis Tool Co., Waynesboro, Pa., for high production in the grinding of spindles and shafts of many types and dimensions. The machines are suitable for grinding crankshaft line bearings, tinning rolls, camshaft main bearings, motor armatures, etc. Small straight-faced rolls can be ground. The machines are built in lengths of 18, 36, 48, and 72 inches, and can be supplied for either hydraulic or hand traverse. They may be used for wide-wheel and multiple-wheel grinding.

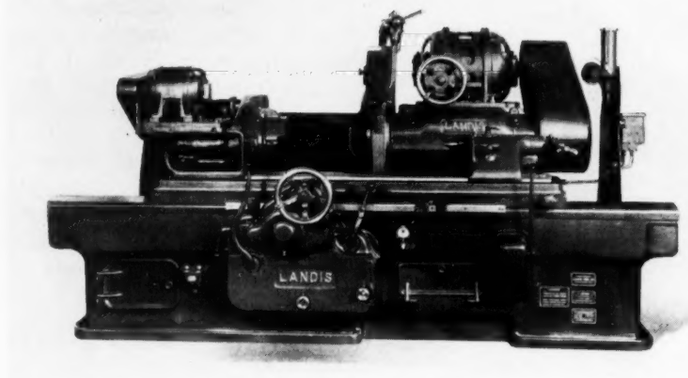
Multiple V-belts drive the wheel-spindle at one end. The wheel-spindle runs in flood-lubricated, cap type, babbitt-lined steel bearings, a feature that makes possible less wheel-spindle clearance than is ordinarily required, and enables a better finish to be obtained on the work. A 30-inch grinding wheel is considered standard, but a 36-inch wheel can be furnished on 10-inch machines or a 42-inch wheel on 14- and 16-inch machines. The larger wheels are especially desirable in grinding crankshaft line bearings, because wheel truing and wheel changing time are considerably reduced.

The hydraulic system provides a wide range of work-table speeds, with smoothness of traverse at any speed between the minimum of 6 inches a minute and the maximum of 240 inches a minute. Owing to the use of dual cylinders, one for each direction of movement, the volume of oil in each cylinder is constant and the speed is therefore constant in both directions. The table speeds are regulated by a valve which governs the flow of oil from the end of one cylinder to the end of the other.

The hydraulic straight in-feed mechanism is available, although it is not standard equipment. When provided for operations such as crankshaft line-bearing grinding, multiple-wheel grinding and most wide-wheel grinding, the wheel is fed in rapidly until it is about to come into contact with the work. It then slows down automatically to a predetermined grinding feed and continues to move in at this slower feed until the base comes against a positive stop. Reversal of the control causes the base to return rapidly to its starting position.

The final drive to the work, that is, from the jack-shaft to the faceplate, is also through multiple V-belts. The work-drive motor is of the constant-speed type, speeds from 65 to 200 revolutions per minute being available simply by changing an easily accessible belt and pulleys at the end of the headstock.

The center line of the work above the floor is only 36 inches on the 10-inch machine, 38 inches



Landis Type D Plain Hydraulic Grinding Machine
Built in 10-, 14-, and 16-inch Sizes

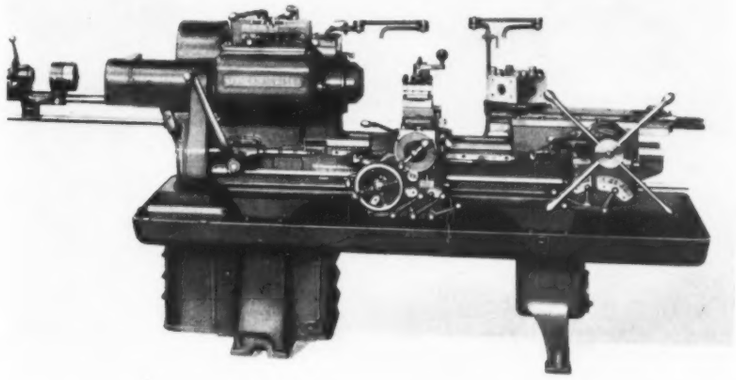
on the 14-inch machine, and 39 inches on the 16-inch machine. These comparatively low heights are particularly advantageous when parts of considerable weight are being ground, because of the reduced energy required on the part of the operator.

Ingersoll-Rand Pott Impact Wrench with Reversible Feature

The Pott impact wrench which was described in February MACHINERY, page 386, at the time that it was placed on the market by the Ingersoll-Rand Co., 11 Broadway, New York City, is now available with a reversing mechanism, so that it can be used both for applying and removing nuts. Reversing is accomplished by shifting gears instead of by reversing the air motor. This method was adopted because a non-reversible multi-vane motor uses about one-third less air than a reversible motor of comparable size. The method also prevents accidental reversing and thus adds to the safety of operation.

Air-cooling of the accumulator is another new feature. It prevents overheating and results in longer life of the equipment. This wrench drives nuts on or off at a speed of from 600 to 700 revolutions a minute, and at the same time, delivers impacts at rates of from 1200 to 1400 blows a minute. This is done by applying torque to the rubber accumulator in such a way that the rubber section is shortened so as to lift the hammer from its seat. The energy stored in the accumulator then drives the hammer forward, so that it delivers a powerful rotary blow to the anvil. A chuck is attached to the anvil. This action makes it possible to remove nuts which could otherwise be taken off only by splitting with a chisel or by applying a torch.

The non-reversible type of impact wrench previously described is still supplied for applications where nuts are to be driven on only.



Warner & Swasey Turret Lathe Designed for Using Tungsten-carbide and High-speed Steel Tools to Best Advantage

Warner & Swasey Turret Lathe of Improved Design

A No. 4 universal turret lathe developed to utilize cemented tungsten-carbide and high-speed steel cutting tools to best advantage is being placed on the market by the Warner & Swasey Co., Cleveland, Ohio. On this machine, twelve spindle speeds ranging from 30 to 751 revolutions per minute are regularly available with a 7 1/2-horsepower motor running at 1200 revolutions per minute. There is, however, provision for applying a two-speed motor so as to obtain twelve additional speeds. The swing of the machine is 18 1/4 inches and it has a bar capacity of 1 3/4 inches.

Anti-friction bearings are supplied throughout the head, the front end of the spindle being mounted in double roller bearings. All the gears in the head are made of chrome-nickel steel, and are hardened and ground. Replaceable hardened-steel strips on the turret saddle make this unit wear-proof. The circumference binder ring automatically clamps the turret after each indexing. The power feed is applied through a friction clutch.

A feature of the cross-slide is a large dial so graduated that a 1/16-inch movement of the rim advances the slide 0.001 inch. The square turret is automatically indexed, which gives increased speed in operating the machine. Pressure lubrication with grease is provided for both aprons, this method keeping the bearings clean and preventing washing away of the lubricant. A plunger pump on the cross-slide lubricates both the slide and the bed ways.

Pick-off gears supplied for the gear-box make it possible to change the entire range of feeds provided by the gears in each apron. The ratchet type bar feed is designed for fast operation to suit high spindle speeds. The bar stock is held concentric with the spindle bore by a revolving feed chuck which is mounted on anti-friction bearings. This affords speed in loading and reduces fatigue of the operator in releasing and gripping the bar. All feed-levers are designed with a finger-tip control, so as to induce the operator to shift to different feeds in production operations instead of using one feed for an entire piece of work.

Spindle speeds are read directly from a plate above the levers of the head, the operator merely having to observe the position of the head levers to know what the speed is. Improvements made in the taper attachment permit it to be used for all cross-slide tools mounted at both the front and rear positions. This unit can be clamped from the position of the operator.

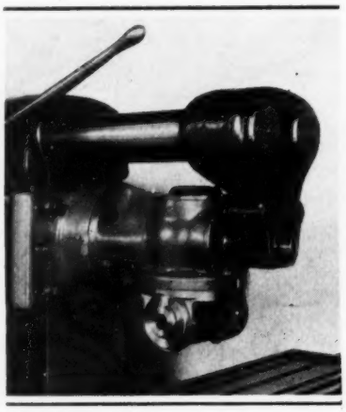


Fig. 1. B&S Milling Attachment which can be Set at Any Angle

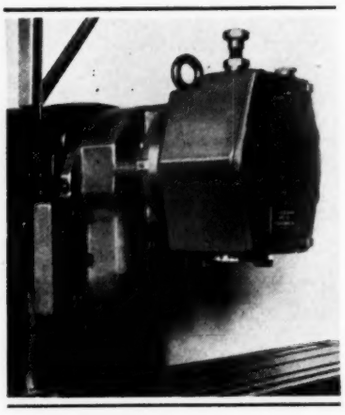


Fig. 2. Attachment Adjustable from Vertical to Horizontal

Brown & Sharpe Universal and Vertical Milling Attachments

A No. 12 universal milling attachment recently added to the line of the Brown & Sharpe Mfg. Co., Providence, R. I., is shown in Fig. 1. This attachment is designed to be used in drilling, in milling angular slots or surfaces, in cutting racks, etc., at the high speeds of modern milling machines. The attachment is securely clamped to the face of the machine column and is supported at the outer end by the arbor yoke. A draw-in bolt is furnished for holding adapters in the spindle.

The head can be positioned and securely clamped at any angle in both the vertical and the horizontal plane, and its position is indicated by graduations which read to half degrees. The spindle is driven by hardened bevel gears and has a B&S taper bore. Antifriction bearings are provided throughout. The ratio of the attachment spindle to the machine spindle is 1 1/2 to 1, and the attachment is suitable for operation at speeds up to 2000 revolutions per minute.

Fig. 2 shows a No. 12H vertical milling attachment which has been brought out to suit the heavier classes of work performed on modern milling machines which often require such equipment capable of running at high speeds.

The spindle of this attachment can be set at any angle from the vertical to the horizontal, the position being indicated by graduations reading to half degrees. The ratio of the spindle of this attachment to the machine spindle is 1 to 1, and the attachment is suitable for speeds up to 1300 revolutions per minute. It is driven through hardened spur and bevel gears.

The spindle has a standard end with a No. 50 milling machine taper hole. A reservoir insures adequate lubrication of the mechanism in all positions of the swivel head.

Both of these milling attachments are intended for use on all styles of Nos. 1, 2, and 3 B&S milling machines, both standard and high-speed models.

Star Precision Drill Grinder

Eighty-one sizes of drills can be accurately sharpened on a precision drill grinder developed by the Star Machine & Engineering Corporation, Bloomfield Ave. and Grove St., Bloomfield, N. J. In operation, the drill is merely inserted in the chuck the proper distance, as shown by an indicator. A thumb-screw is then loosened on the front of the chuck, the chuck is rotated until one lip of the drill comes into the position shown by the zero dial reading of the indicator, and the thumb-screw is retightened.

The cam-handle is next moved from right to left, and at the same time, the chuck carriage is fed to the required depth of cut. The cam-handle is moved through its entire arc to complete the grinding of the first lip. In grinding the second lip, the same procedure is followed, except that the chuck carriage is not moved.

Bench Machine Designed for Accurately Grinding Eighty-one Sizes of Drills

Twenty-five fractional-dimension drills from 1/8 to 1/2 inch can be handled by this drill grinder, as well as numbered drills from No. 1 to 30 and all letter-size drills. No attachments are required. Drills that are intended for use on cast iron and steel are ground with a 59-degree lip angle, a drill-

point angle of from 120 to 135 degrees, and a lip-clearance angle of 12 degrees. The 59-degree lip angle can be changed by adjusting the graduated compound rest, so as to adapt the machine for countersinks or drills to be used in cutting soft materials. Drill sharpening is done on the periphery of the wheel, which reduces the tendency to burn the drills.

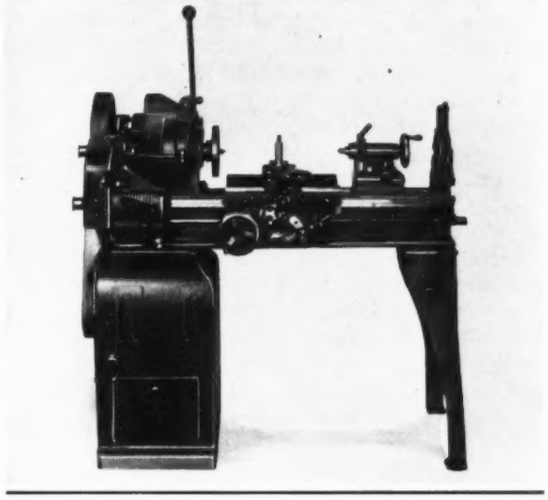
An extra coarse wheel is mounted on the left-hand side of the machine for roughing down damaged or broken drills. This permits the wheel on the right-hand side to be kept for finish-grinding. Alternating- or direct-current motors can be supplied.

Sebastian Motor-Driven Cone-Head Lathes

A line of low-priced motor-driven cone-head lathes is being introduced on the market by the Sebastian Lathe Co., Cincinnati, Ohio, in swings from 10 to 20 inches, inclusive. The 12-inch by 4-foot machine illustrated has a distance between centers of 22 1/2 inches when the tailstock is flush with the end of the bed. The swing is 8 3/8 inches over the carriage and 12 1/4 inches over the bed. Feeds ranging from 0.008 to 0.252 inch are available. Six speeds are provided.

The motor is enclosed in the cabinet leg and transmits power through a V-belt to a cone pulley at the rear of the lathe. A flat belt conveys the drive from this pulley to the cone pulley of the headstock. The motor is mounted in such a way that the adjustment of a single screw will take up any belt play. Starting and stopping of the lathe, as well as reversing, are accomplished through a drum type safety switch, mounted within convenient reach of the operator. There is a lever adjustment for keeping the cone belt tight. As a safety measure, the guard over the cone belt is so arranged that it cannot be lifted without first stopping the motor.

The carriage is tongued and grooved to the apron, and is hand-scraped for its entire length on the bed. A safety interlock on the apron prevents engagement of both the screw and length feeds at the same time. The reverse plate is so adjusted that the gear teeth cannot be engaged too deeply in changing from left- to right-hand threads and vice versa.



Sebastian Cone-head Lathe, Built in Swings from 10 to 20 Inches

Machine that Preheats 1000 Studs an Hour for a Hot Forming Operation

Taylor-Winfield Automatic Electric Resistance Heating Machine

A machine that electrically heats tapered studs made from screw machine stock prior to hot-forming them in a press has recently been designed by the Taylor-Winfield Corporation, Warren, Ohio, and Detroit, Mich. This equipment heats 1000 studs an hour. The actual current dwell, during which two pieces are heated simultaneously, is less than three seconds. A 75-kilovolt-ampere transformer is mounted within the base.

In construction, the machine follows the general arrangement of the spot and projection welders built by the same concern. The base and other parts of the frame are made of welded sheet steel. Except for feeding the studs by hand into the indexing fixture, the operation of the machine is entirely automatic. The dial mechanism is operated at a suitable speed by a small motor and gear-reduction unit.

The upper electrodes are brought to bear on the studs by means of an air cylinder operated from the dial indexing mechanism, with the result that all

movements are so synchronized that no attention is necessary from the operator. When the studs are heated to a predetermined temperature, they are ejected by an air cylinder into a chute which carries them to the hot forming operation. The length of current dwell in heating is governed by an electronic timer.

Similar equipment can be furnished for many other heating operations on parts of practically any shape. The process is particularly adapted to the production heating of wire or slugs from which bolts are to be made.

Cincinnati Cutter and Tool Sharpening Machine with Duplicate Controls

The No. 2 plain and universal cutter and tool sharpening machine built by the Cincinnati Milling Machine Co., Cincinnati, Ohio, has recently been improved by the adoption of a solid and heavier table slide and by the addition of duplicate operating controls on the left-hand side of the machine, as viewed from the rear. The new table slide reduces vibration to a minimum in grinding large rotary cutters, thus providing a truer and more even cutting edge on the tools. The solid table also permits heavy loading when it is displaced angularly, as in grinding dovetail milling cutters.

The left-hand operating controls increase the adaptability and universality of the machine. Regardless of the type of work, a normal operating position is afforded. The machine retains the previous arrangement for correctly locating the work and tooth-rest with respect to the grinding wheel. Unlimited visibility of the work and grinding wheel, accessibility for making changes in the set-up and for truing the grinding wheel without leaving the operating position at the left- or right-hand side of the machine, as well as safety of operation, are additional features.

The grinding of left-hand milling cutters and spiral reamers is best performed from the left-hand side of the machine with the operator facing the machine from the rear.

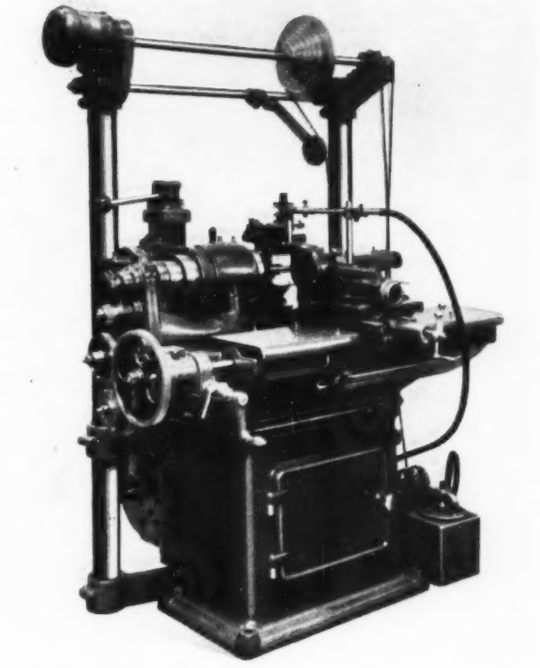
Vacuum Power Switch

The Continental Electric Co., 210 S. First St., St. Charles, Ill., is announcing a vacuum power switch in which is incorporated a solenoid that controls the position of the contacting mechanism in making or breaking the circuit. This switch eliminates the need of tilting or rotating devices. The contacting mechanism is sealed in a high vacuum chamber so that there can be no oxidation or difficulties with dust, lint, or other particles of inflammable material that may be cast off in manufacturing operations.

The switch can be used for remote-control and high-voltage installations for automatic equipment, traffic signals, sign-flashing, etc. It is cylindrical in shape and measures 5 1/2 inches in over-all height by 1 1/2 inches in diameter. There are two types—the VPS-1 in which the single contact is normally open, and the VPS-2 in which the single contact is normally closed. This switch will make up to 100 contacts a minute under full-load operating conditions and even higher speeds under other conditions.

Fig. 1. Front View of the Improved Cincinnati No. 2 Cutter and Tool Sharpening Machine

Fig. 2. In Grinding Left-hand Cutters, a Makeshift Tooth-rest Set-up is Unnecessary



Precision Thread Grinder Marketed by the Triplex Machine Tool Corporation

Examining Metal Parts Fluoroscopically as They Move Along a Conveyor Line

Tool-Room Thread-Grinding Machine

A motor-driven tool-room type of machine for finish-grinding the screw threads of external and internal gages, taps, and hardened production parts has been brought out by the Societe Genevoise d'Instruments de Physique, Geneva, Switzerland, and is being placed on the American market by the Triplex Machine Tool Corporation, 125 Barclay St., New York City.

Power is transmitted from a two-horsepower motor, mounted at the rear of the bed, through a back-shaft and cone pulley on the machine to the work-head. Six work-head speeds are provided. Eight wheel-spindle speeds are obtained by means of a grooved pulley mounted on the overhead shaft which is driven by a separate one-horsepower motor.

This machine is equipped with a master lead-screw which is protected from grinding dust and dirt, enabling lead-screws to be ground within close limits of accuracy. The lead-screw of the machine is provided with a correcting device, while a vertical microscope fitted over the top of the wheel provides a satisfactory means of controlling the profile angle of the wheel and of the work-piece during the grinding process. A correcter is furnished that compensates for variations in temperature from 32 to 68 degrees F.

The grinding-wheel head can be tilted to any angle required. A diamond truing device is furnished to keep the wheel dressed to proper angles. A water pump and piping are provided for wet grinding, so as to enable a good finish to be obtained on threads and to carry away the emery dust.

This machine can be used for grinding external threads from 3/16 inch to 6 inches in diameter and up to 12 inches long between centers. External grinding is performed with the work driven by dogs. Internal threads from 1 1/4 to 5 inches in diameter can be ground.

X-Ray Equipment for Production-Line Inspection

Products can now be inspected fluoroscopically as they progress along a conveyor line by means of equipment recently developed by the Adrian X-Ray Mfg. Co., 3535 N. Palmer St., Milwaukee, Wis. As the products pass through the machine, the operator looks through an eye-piece to get an interior view of each part. Any part that does not come up to requirements is marked for rejection by means of a pointer device.

With this equipment, aluminum castings can be examined for flaws; parts made of mica or Bakelite can be inspected to detect pieces of metal that might interfere with their efficiency as insulation; slate can be checked for rust spots; asbestos shingles and porcelain can be examined for cracks, etc. Fluoroscopic examination has been done with this machine through 1/4-inch steel plate. The machine has a

radiograph attachment for taking X-ray photographs of any specific part, in case they are required. Radiographs have been made through one inch of steel.

Although the equipment has a capacity of 150,000 volts, it uses only about as much current as two ordinary flat irons. Special tubes have been constructed and a cooling arrangement devised which permit continuous operation during working hours. No technical knowledge is required by the operator, and he is not exposed to the X-rays.

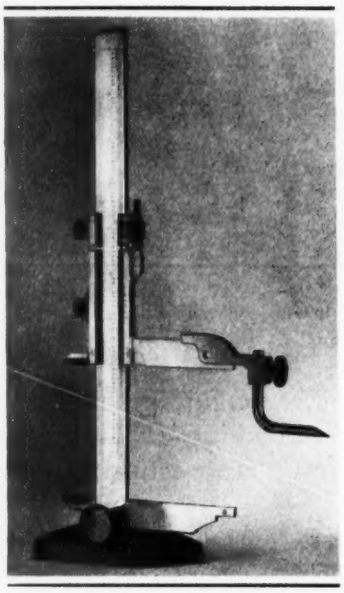
The scriber is readily attached to the upper jaw of the caliper. The scribing needle is adjustable to enable the heights to be read directly from the scale. Verniers are provided to read to 0.001 inch and to 1/128 inch.

Horizontal Friction Type Tapping Machines

A "Marvel" line of motor-driven friction type tapping machines of horizontal design has been added to the products of the Armstrong-Blum Mfg. Co., 343 N. Francisco Ave., Chicago, Ill. The line includes seven models or sizes which are all available in bench and floor types. They are designed to have a smooth friction action which prevents tap breakage. The machines have a capacity for cutting fine threads from No. 0 to 1/2 inch, U. S. standard, in steel.

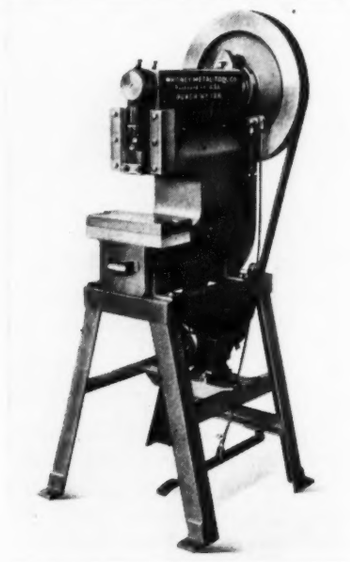
Each machine is built with a sliding table, provided with a micrometer screw adjustment to facilitate accurate tapping to required depths.

These tapping machines can be supplied with a spring-return sliding-table action only; a rear-lever action with a spring return; or a front-lever action with an automatic depth trip and an automatic reverse. Floor models can also be supplied with a foot-treadle action, an automatic depth trip, and an automatic reverse. Quick-change spindles can be provided for threading, tapping, nut- or stud-driving, etc. A special two-tap geared spindle is available for threading holes from No. 0 to 1/4 inch. Plain model machines can be provided with any of this equipment.



Height Gage which Gives Readings Direct

Motor-driven Friction Type Tapping Machine



Heavy-duty Punch Added to the Whitney Line

Mauser Convertible Height Gage

An improved type of convertible height gage, recently added to the line of Mauser precision tools handled in this country by the George Scherr Co., 128 Lafayette St., New York City, is shown in the accompanying illustration. This tool consists of a toolmaker's caliper of the standard Mauser make, which is now available with knife-edge points at the rear of the jaws. For use as a height gage, a lapped base is furnished in which the caliper is located and held by a centering clamp screw.

Whitney Heavy-Duty Punch

The latest punch to be added to the line of the Whitney Metal Tool Co., 110-114 Forbes St., Rockford, Ill., is of all steel-plate welded construction. This No. 128 model, which is here illustrated, is equipped with a 3/4-horsepower motor for operation on ordinary lighting circuits, if desired. The motor is provided with a 3-to-1 gear reduction, so that the machine runs at the rate of 135 strokes a minute. The length of stroke is 1 1/4 inches.

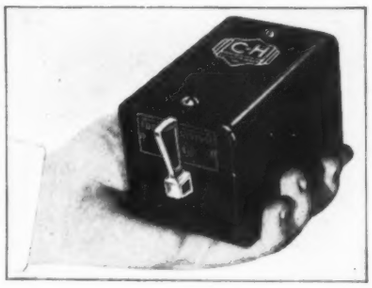
In designing this machine, simplicity of construction was

the aim, and all parts have been standardized so as to facilitate any replacements that may become necessary. Power is transmitted from the motor to the flywheel through V-belts. Three station clutch pins are provided on the flywheel. The main shaft is equipped with an adjustable brake-shoe, and there is a safety device which prevents the ram from descending when punches and dies are being changed. Slugs punched from sheet metal are caught by the metal drawer. Automatic stock-feeding devices can be furnished to suit individual requirements. This punch has a weight of 710 pounds.

Small Drum Switch for Alternating or Direct Current

A small size drum type reversing switch of simple construction but high capacity has recently been developed by Cutler-Hammer, Inc., 429 N. 12th St., Milwaukee, Wis. This new switch, which is known as the Bulletin 9441 Type VI is of the across-the-line type. It is provided with "Twin-break" contacts and molded arc barriers to give an unusually high rating and long life. The switch can be furnished either with a standard enclosure or as a skeleton drum equipped with a mounting plate for built-in applications on machines.

This switch is applicable to almost any type of single-phase or polyphase alternating-current motor and also to direct-current



Small Drum Switch Added to the Cutler-Hammer Line

motors. With single-phase alternating-current motors, the switch has a rating of 1 horsepower, 110 volts or 1 1/2 horsepower, 220 volts. With polyphase motors, the rating is 1 1/2 horsepower, 110 volts or 2 horsepower, 220, 440, or 550 volts. With direct current of 115 or 230 volts, the rating is 1 horsepower. The nominal eight-hour rating is 15 amperes.

Fafnir Ball Bearings of Increased Precision

Three new types of ball bearings designed for high-speed use when extreme accuracy is required, are being introduced to the trade by the Fafnir Bearing Co., New Britain, Conn. The bearings are of the single-row radial type, with both the rings and balls made of high-carbon chromium steel. Deep-groove races afford maximum thrust capacity and cushioning support under shock loads.

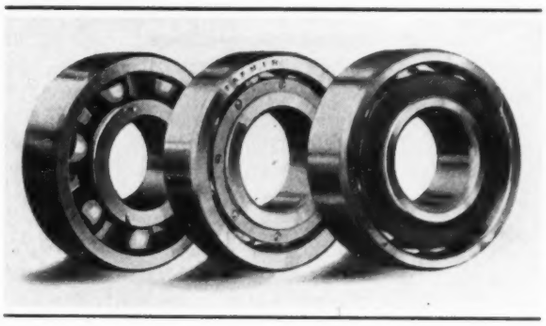
The M type bearing shown at the left in the illustration is available in all standard sizes for light, medium, or heavy loads. It is manufactured to standards of accuracy substantially greater than those required by S A E specifications.

Bearings made to equally close tolerances, but equipped with a special machined and ring-piloted bronze retainer that insures concentricity in operation, are also being made in a wide range of sizes. One of this series of bearings, known as the WW type, is shown in the center of the illustration. It has been developed particularly to meet the rigorous service to which high-speed woodworking machinery is subjected.

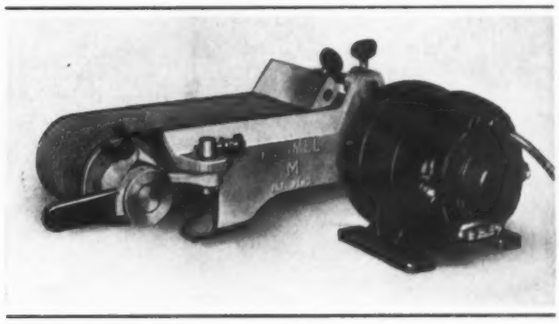
Still another series of bearings made to achieve even greater accuracy than the M type has been developed for high-speed machine applications and special uses. These MM type bearings one of which is shown at the right, may be obtained with special composition retainers instead of steel or bronze to provide lightness that will facilitate running in balance. Standard sizes of these bearings are available in the light series with bores from 0.3937 inch to 4.3307 inches, and in the medium series with bores from 0.6693 inch to 2.1654 inches. Other sizes are being added to the line to meet needs.

Hormel-M Abrasive Band Grinder

An eccentric tension device is provided on a Hormel-M band grinder, placed on the market by



Three Types of Fafnir Bearings Manufactured to Meet Extra Precision Requirements



Band Type Grinder and Sander with Belt-changing Feature

the Walls Sales Corporation, 96 Warren St., New York City, which enables abrasive bands to be changed be merely manipulating a lever. Another feature of this equipment is an adjustment for properly aligning the band. At one end of the table is a leg designed to prevent vibration or tipping of the machine.

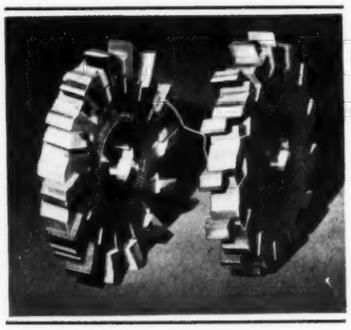
Above the abrasive band there is an adjustable bevel attachment, which is always close to the table, regardless of the angle at which it is set. The machine is equipped with ball bearings throughout, and the motor shaft runs in heavy-duty ball bearings. The motor is of 1/4 horsepower capacity and runs at 1750 revolutions per minute. It is specifically designed for cool operation and at the same time to exclude dust and dirt. Fittings and a grease gun are provided for lubricating the grinder by the Alemite system.

The machine is designed to use belts 4 inches wide by 36 1/4 inches long, the table measuring 4 1/2 by 9 inches. The pulleys are of a non-slip construction, and are 3 1/2 inches in diameter by 4 1/2 inches long. This abrasive grinder is intended for the roughing, smoothing, and fine-finishing of a large variety of work.

Ingersoll Side Milling Cutters with Zee-Lock

In June MACHINERY, page 646, was described a line of inserted-blade face milling cutters placed on the market by the Ingersoll Milling Machine Co., Rockford, Ill., in which Z-shaped wedges are employed to retain the blades in the body. This Zee-Lock principle has now also been applied to side milling cutters. It will be remembered from the previous description that each Z-shaped wedge hooks over the front of the cutter body and over the back of the blade in such a manner that it is impossible for the blade to shift backward or inward away from the cut. The back hook of the wedge is slanted, so that when the blade is reinserted and moved out a distance of one serration, it also moves forward a slight amount to compensate for the wear on the face of the cutter.

Side milling cutters of various styles are included in the line. The illustration shows right- and left-hand half-side cutters. Staggered-tooth or alternating-angle cutters for slotting or keyway operations are also made, as well as side and interlocking cutters having plain wedge locks. The line includes cutters as small as



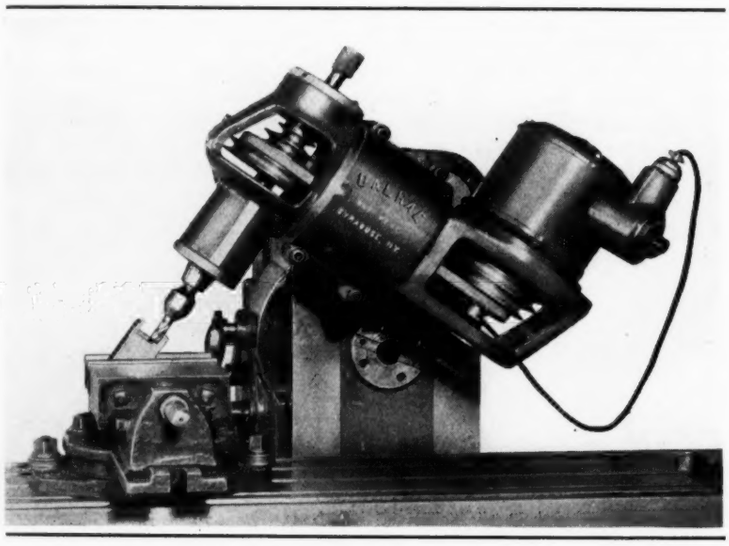
Side Milling Cutters with the Ingersoll Zee-Lock

4 inches in diameter by 1/2 inch in width. Blades can be supplied of forged, hardened, and ground high-speed steel; super-cobalt high-speed steel; and J-metal Stellite or tipped with cemented carbide. When worn, the blades can be used in smaller cutters.

Dalrae "Speedmill" Attachment

A high-speed milling attachment intended for use on milling machines and horizontal boring mills has been placed on the market by the Dalrae Tools Co., Syracuse Bldg., Syracuse, N. Y. Mounted on the over-arm of a machine as shown, this attachment can be swiveled in four directions for milling at any angle. It eliminates the necessity of using large-capacity motors for cuts made with very small end-mills, and it provides the proper speeds for such work, thereby permitting smooth fast cuts, decreasing the cost of power, and reducing the breakage of small tools.

The attachment is manufactured in one size only, but it can be equipped with either a 1/4- or 1/2-horsepower motor to meet individual needs. Speeds of 500, 1200, 2500, and 4000 revolutions per minute are available with the 1/4-horsepower motor, which gives a capacity for driving cutters from 1/16 to 9/16 inch in milling steel. With the 1/2-horsepower motor, speeds of 350, 650, 1700, and 3000 revolutions per minute are available, and the attachment has a capacity for mill-



High-speed Milling Attachment for Milling Machines and Horizontal Boring Mills

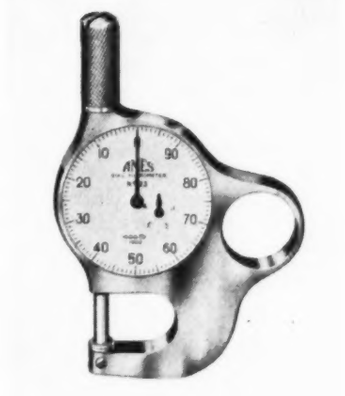
ing steel with cutters from 1/8 to 7/8 inch.

The attachment is well balanced to facilitate mounting and setting, as well as to guard against undue swinging of the head in case it should become accidentally loosened. Aluminum-alloy castings are used throughout, bringing the weight of the attachment to 66 pounds when driven by a 1/4-horsepower motor, and to 86 pounds when driven by a 1/2-horsepower motor. The spindle housing, main swivel, and motor mounting are all contained in one casting, which reduces the possibility of chatter to a minimum. A reversing switch provides for right- and left-hand cutting. Squaring surfaces and a graduated scale facilitate setting the attachment to different angles.

Ames Dial Micrometer

Readings can be taken with accuracy, at a great saving in time and without eye-strain, by means of a No. 23 dial micrometer being introduced to the trade by the B. C. Ames Co., Waltham, Mass. This micrometer is of 1/2 inch capacity. A small hand on the dial face indicates the number of revolutions made by the large hand in taking a measurement. The knurled barrel at the top of the frame is turned to operate the spindle and to open and close the measuring anvils. This is instantly accomplished by a slight movement of a finger on the hand that holds the micrometer.

A dial which gives fractions and their decimal equivalents is attached to the back of the micrometer. The interior mechanism is similar to that of the No. 25 thickness measure made by the same concern. The case is rustless and the crystal unbreakable. This dial micrometer fits a vest pocket as readily as a watch, and weighs only 5 ounces.



Dial Micrometer Designed for Easy Reading of Dimensions

Ball Thrust Bearing 54 Inches Outside Diameter

Bantam Thrust Bearings of Large Diameter

A ball thrust bearing, 54 inches outside diameter, 48 inches inside diameter and 4 1/2 inches thick, was recently made by the Bantam Ball Bearing Co., 3400 W. Sample St., South Bend, Ind., for application on an automatic multiple-operation machine that bores and reams automobile cylinder blocks.

This machine, which was built by the Hammond Mfg. Co., Cleveland, Ohio, is equipped with a table, 95 inches in diameter, that carries the jigs and engine blocks. The ball thrust bearing supports this indexing table. Owing to the close limits specified on the boring and reaming operations, the ball thrust bearing had to be of high precision.

Machine for Grinding Die-head Chasers up to 1 1/4 Inches Wide

Landis Grinder for Die-Head Chasers

Die-head chasers up to 1 1/4 inches in width can be sharpened on a Model O chaser grinder recently added to the line of grinding machines built by the Landis Machine Co., Inc., Waynesboro, Pa. This machine is of a medium size, and can be furnished as a bench type or with a pedestal for floor use. It is driven by a 1/3-horsepower motor, operating on single-phase, 120-volt, 60-cycle, alternating current, so that it can be driven from an ordinary lighting socket.

The motor and grinding-wheel spindles are mounted in ball bearings. At one end of the grinder is a 6- by 2-inch cup-shaped wheel, and at the other end, a 7- by 1/2-inch straight wheel. Both wheels are of suitable grade and grain for grinding chasers made of high-speed steel.

The right-hand side of the machine is fitted with a swivel fixture for grinding the rake and lead angles. Graduations facilitate accurate settings to the required angles. The fixture is mounted on a rotatable spindle which permits the chasers to be oscillated against the face of the cup-wheel. A cross-feed is obtainable through a hand-knob on the left-hand side of the bed. The chaser is held in the vise by a dovetail and is secured by a second hand-knob.

The left-hand side of the machine is equipped with an adjustable fixture for grinding the

lip of the chasers at the rake angle. Means are provided on the table of this fixture for controlling the lead angle and thus insuring uniform grinding. The machine provides for sharpening all forms of chasers as recommended in the Landis Handbook.

Thor Balancers for Suspending Portable Tools

A line of balancers ranging in capacity from 10 to 200 pounds is being introduced on the market by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. These balancers are intended for suspending portable tools above benches or assembly lines and for use as small hoists.

Each balancer is made with a tapered drum which insures balance of the load at any point within the range of travel of the device. The travel is either 4 or 6 feet, depending upon the capacity of the balancer. Each unit can be adjusted to suit the load to be handled. Four sizes are equipped with a locking and unloading device.

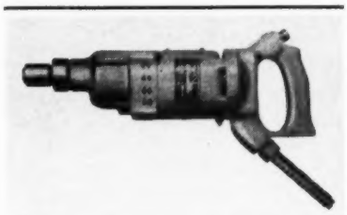
Thor Balancer Made in Capacities up to 200 Pounds

Holder for Parting or Cut-Off Tools

A tool-holder designed for holding parting or cut-off tools in an inverted position, as shown in the upper portion of the illustration, has been placed on the market by the Inverted Tool Holder Co., 1230 E. 109th St., Los Angeles, Calif. When this tool is being used, the lathe or machine spindle which carries the work is rotated backward, so that the thrust of the tool is downward. The machine spindle is thus kept seated solidly in its bearing and chattering is reduced to a minimum.

Holder Devised for Parting or Cutting-off Tools

Other advantages of this toolholder are that the operator can clearly see the cut and that the chips fall away from the work. It is claimed that the holder saves tool breakage, eliminates clearance worries, and requires less frequent grinding of tool bits. The wedge method of fastening, which is apparent from the lower portion of the illustration, is simple yet positive in action. A slight forward tap on the wedge knob will loosen the tool bit, while a slight tap backward will tighten the wedge and hold the tool bit firmly in place.



Hercules Portable Screwdriver and Nut-setter

Portable Tool for Screw and Nut Driving

A high-frequency electric screwdriver designated as No. 21-S has been added to the Hercules line of tools, made by the Buckeye Portable Tool Co., Dayton, Ohio. With the use of an extra socket, this tool can also be used for light nut-setting. It can be furnished with a reversing switch.

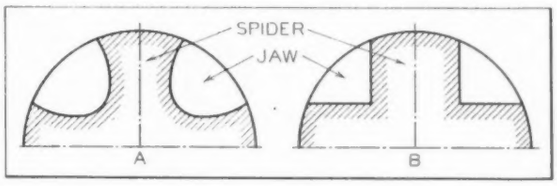
Speeds of 500, 750, and 1000 revolutions per minute are available. The tool has a capacity for driving Nos. 12 and 14 screws or 3/16- and 1/4-inch nuts. It has an over-all length of 15 inches, a weight of 7 1/2 pounds, and operates on three-phase, 180-cycle, 110- or 220-volt current.

L-R Flexible Coupling with Convex Jaw Surfaces

The Lovejoy Tool Works, 5021 W. Lake St., Chicago, Ill., has brought out a Type IA flexible coupling, which, instead of having parallel jaw surfaces where the outer edges of the jaws bear on the cushioning spider, as in the conventional L-R couplings made by this concern, is provided with convex jaw surfaces that exert a rolling pressure when bearing on the spider arms. The new and old types of construction are shown at *A* and *B*, respectively, in the accompanying illustration. The convex surfaces insure a substantially uniform compression of the resilient cushioning material, so that each portion of the arm bears an equal share of the load. Wear occurs uniformly over the entire surface of the spider arm and thus renders

it useful as a cushioning agent for the metal jaws until the spider is practically worn out.

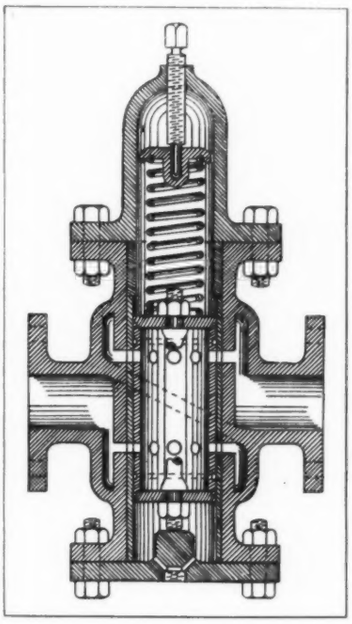
Another advantage of the new construction is that it increases the life of the cushioning spider approximately 50 per cent without necessitating an increase in the outside diameter or length of the coupling. Other features are a three-part construction (two metal flanges and the one-piece spider) which facilitates assembly and installation; a spider member with sufficient resilience to safeguard connected machines against shocks, overloads, or misalignment; and quietness of operation. These Type IA flexible couplings are made in standard sizes with bores from 1/4 inch to 3 inches, the capacities ranging from 1/12 to 200 horsepower at 1750 revolutions per minute.



Diagrams Illustrating Jaw Designs of Lovejoy Flexible Couplings

Robuell Pressure Control Valves

Valves for controlling the pressure, speed, flow, and load of steam, air, oil, water, gas, or chemicals are being placed on the market by the Valve Division of the Crankshaft Machine Co., Jackson, Mich. A feature of these valves is that they have only one moving part, thus making for simplicity and the elimination of service problems. Piston wear is absorbed by leak-proof rings. The valves can be installed vertically, diagonally, horizontally, or completely inverted.



Pressure Reducer and Constant-pressure Pump Governor

In the machinery field, the valves have been applied on hydraulic feed lines and in hydraulic clamping applications. The Series A valve illustrated can be used either for straight pressure reduction or as a constant-pressure pump governor. The alloy-steel spring is treated to withstand ultra-high temperatures, so that it will stand up under severe conditions of service. The valve will not wire-draw, chatter, or pulsate. The sliding cut-off effect, closing against a spring and opening on a pressure cushion, eliminates pounding.

In addition to the Series A valves, there is also a Series B which is adaptable to very high pressures, and a Series C which is equipped with an excess-pressure boiler feed-pump governor that shuts off in case of a broken line and prevents racing or overspeeding of a pump.

These valves are regularly made in eleven sizes ranging from 1/2 inch to 8 inches, inclusive.

Alnor Horizontal Edgewise Pyrometer

A horizontal edgewise pyrometer which can be furnished with or without a multi-point switch has been brought out by the Illinois Testing Laboratories, Inc., 141 W. Austin Ave., Chicago, Ill. When provided with the switch, there may be eight, seventeen, eighteen, or twenty-five circuits. Both the indicator and switch are waterproof, fume-proof, and dust-tight.

The indicator is constructed to withstand severe vibration, jars, or shocks and to provide long service. Proper damping of the moving element prevents the pointer from over-swinging or oscillating even under heavy shocks. Accurate readings are easily obtained because of the legible markings on the 6-inch scale, the fine pointer, and the mirror which avoids errors due to parallax. A manually operated cold-end adjusting screw is regularly provided, but an automatic internal cold-end compensator can be furnished. The pyrometer is 7 1/4 inches wide, 10 1/4 inches high, and 7 inches deep. It has a net weight of 13 pounds.

Horizontal Edgewise Pyrometer Designed for Easy Reading

The rotary selector switch is enclosed in a water-tight aluminum housing that is provided with binder posts for the thermo-couple wires. A thermo-couple is, of course, required for each zone of which a temperature reading is wanted.

Milligan & Wright Floor Model Blueprinter

A floor model Angstrom-lamp blueprinter has been announced by the Milligan & Wright Co., 4616 Prospect Ave., Cleveland, Ohio. This equipment is constructed with washing and fixing trays and drawing-boards mounted on the base or stand. The illustration shows the trays extended for use. When they are slid back into place, the floor space required is only 28 by 30 inches.

This blueprinting equipment is instantly made available for use by simply plugging into any 110-volt alternating- or direct-current light socket. Prints are made with exposures of from 3/4 to 1 1/2 minutes only, depending upon the quality of the drawing and the paper used. A time switch cuts off the electric current at the end of the exposure period selected, thus further simplifying the operation. This Model 200 blueprinter has a capacity for producing one print 18 by 24 inches or several smaller prints at one time.

Blueprinting Equipment of Floor Type Brought out by the Milligan & Wright Co.

* * *

Nickel Cast Iron for High-Pressure Cylinders

In the manufacture of the lifting jacks made by the Walker Mfg. Co., Racine, Wis., a hydraulic unit is employed that must be capable of withstanding oil pressures ranging from 10,000 to 15,000 pounds per square inch. At first, malleable castings were tried, but they were likely to be too porous; and, since this could not be discovered until after the castings were machined, the use of this material caused considerable expense.

Now, by using a nickel cast iron, a hydraulic unit for high pressures has been produced that is fully satisfactory. This is, in reality, a semi-steel. There is from 50 to 60 per cent steel in the mixture; total carbon, from 3.20 to 3.30 per cent; nickel, from 1.50 to 1.60 per cent; silicon, from 1.30 to 1.50 per cent; and manganese, from 0.50 to 0.60 per cent.

* * *

Using Liquid Nitrogen for Shrink Fits

According to *Automotive Industries*, liquid nitrogen is being used by some French concerns for making shrink fits of engine parts. At atmospheric pressure, liquid nitrogen has a temperature of minus 320 degrees F. It is used in double-walled containers.

When a metal piece is submerged in the liquid, violent boiling takes place. When the boiling ceases, the piece is at about the same temperature as the liquid and ready to be placed in the part in which it is to be a shrink fit.

The amount of liquid that evaporates in cooling the metal piece depends solely on the weight of the piece, the form of the piece having an effect only on the time required to cool it. Parts may also be assembled by employing a combination of heating and cooling, in cases where they cannot be satisfactorily assembled with the proper shrink fit by employing heat alone. For example, sufficient heat to give the required amount of expansion may injure the part. One of the cases where both heating and cooling are employed is in assembling a cylinder and cylinder head. The cylinder is cooled in liquid nitrogen to produce a shrinkage of 0.008 inch on a threaded part having a diameter of 4.96 inches, while the cylinder head is heated to a temperature of 350 degrees in a gas furnace, which does not impair its mechanical properties.

* * *

Watch the Oil Filters

In the publication *Oil-Ways*, issued by the Standard Oil Co. of New Jersey, M. D. Bush, lubrication engineer of the Standard Oil Co. of Louisiana, Little Rock, Ark., calls attention to the need for taking care that oil filters do not clog. He relates the following experience: Oil in a gyratory crusher at the plant of the Malvern Gravel Co., Malvern, Ark., was foaming. The bearings ran hot, and a plant shutdown was necessary. This helped cool the oil and the crusher was started again. Again the bearings ran hot. An engineer for an oil company was called in. He found that the correct oil was being used and everything was all right except the cotton cloth filters. The oil was not being filtered fast enough, and the filters were clogged. After changing them, the trouble stopped.

NEWS OF THE INDUSTRY

Connecticut

WALTER L. TANN has joined the engineering department of the Farrel-Birmingham Co., Inc., Ansonia, Conn. Mr. Tann has had a diversified experience in various phases of mechanical engineering and industrial management. For the last eight years, he has been executive engineer for the engineering firm of Peter Clark, Inc., of New York City.

Illinois

A. M. CANDY, an authority on arc welding, has been appointed consulting engineer on the staff of the Hollup Corporation, 3357 W. 47th Place, Chicago, Ill., manufacturer of welding wire and

A. M. Candy, Recently Appointed Consulting Engineer for the Hollup Corporation

supplies. Mr. Candy will be engaged in the development of welding machines and other equipment, and in research and development work in improved welding practice. His work will be an extension of the research and development work in welding carried on by the Hollup research laboratories. Mr. Candy has been connected with the Westinghouse Electric & Mfg. Co., for many years.

LINK-BELT CO., 910 S. Michigan Ave., Chicago, Ill., has appointed WOODWARD & MCMILLAN, Aptdo 1691, Edificio Metropolitana, Havana, Cuba, exclusive representatives for the sale of Link-Belt elevating, conveying, and power transmitting chains and machinery in Cuba. Announcement is also made of the appointment of the CONSTRUCTION EQUIPMENT CO., 2274 Main St., Hartford, Conn., as distributor of Link-Belt crawler-mounted shovels, cranes, draglines, and track type locomotive cranes.

E. W. LANGDON, manager of the Reinforcing Bar Division of Joseph T. Ryerson & Son, Inc., 16th and Rockwell Sts., Chicago, Ill., was recently elected president of the Concrete Reinforcing Steel Institute.

Indiana

BANTAM BALL BEARING CO., 3400 W. Sample St., South Bend, Ind., has placed a contract for an addition to its plant which will enlarge the company's floor space 60 per cent. This is in line with a general expansion program, based on the assurance of sharply increased orders for ball bearings from the automotive, steel mill, machine tool, and allied industries. The new factory unit will be of steel and brick construction conforming with the design of the present factory building. In addition to increasing the floor space, the company has recently augmented its mechanical facilities for machining, heat-treating, and grinding by over 50 per cent, and other developments are being planned.

WILLIAM B. COOLEY, formerly general sales manager of the Hevi Duty Electric Co., Milwaukee, Wis., has been placed in charge of the sales in the Indiana territory of the heat- and corrosion-resistant alloy castings made by the Michiana Products Corporation, Michigan City, Ind. Mr. Cooley's office is located at 433 N. Capitol Ave., Indianapolis. PAUL S. MENOUGH, formerly of the Michigan Steel Casting Co., Detroit, Mich., has been appointed representative for the Michiana Products Corporation in the Pennsylvania district. Mr. Menough's office will be in the Chamber of Commerce Bldg., Pittsburgh, Pa.

Michigan and Wisconsin

PIONEER ENGINEERING & MFG. CO., formerly of 8316 Woodward Ave., Detroit, Mich., designer of tools, dies, gages, and special machinery, and manufacturer of Rollway coolant and lubricant pumps and Pioneer centrifugal and hydraulic pumps, has increased its capacity to seventy engineers, in addition to increasing its manufacturing facilities by moving to a larger building at 31 Melbourne Ave., Detroit.

MACKLIN CO., Jackson, Mich., manufacturer of grinding wheels, has started construction on additions to its plant which will increase the capacity 50 per cent, affording a total floor space of 70,000 square feet. All departments will be expanded and it is anticipated that the company's working force will be substantially enlarged. A steady growth in business has necessitated this expansion.

T. J. BRADY, formerly of the Accurate Tool Co., Detroit, Mich., has been placed in charge of the sale of grinding wheels in the Detroit district for the mechanical goods division of the United States Rubber Products, Inc., 1790 Broadway, New York City.

BRYANT MACHINERY & ENGINEERING CO., 400 W. Madison St., Chicago, Ill., general distributor for Boye & Emmes lathes, Dreses radial drills, Kling heavy-duty grinders, Ohio shapers and horizontal boring machines, Cleereman heavy-duty drilling machines, and Swift flash, spot, and projection welding machines, has appointed W. G. NICHOL CO., 711 W. Michigan St., Milwaukee, Wis., exclusive agent in the Milwaukee territory.

CHARLES W. DANIELS has been appointed general sales manager for the P & H-Hansen arc welders and industrial products made by the Harnischfeger Corporation, Milwaukee, Wis. Mr. Daniels has been connected with the Harnischfeger Corporation in various capacities for many years. Previous to his present appointment, he was in charge of the Philadelphia office, and will be succeeded there by L. M. STOUT. Mr. Daniels' headquarters will be at the Milwaukee office.

New York and New Jersey

P. M. MAHLER & CO., INC., 80 Broad St., New York City, has been organized to represent a group of non-competing manufacturers of special woodworking machines and allied equipment in foreign countries. The president of the concern, P. M. Mahler, has been export manager of the J. A. Fay & Egan Co., Cincinnati, Ohio, for the last twelve years, and has traveled extensively abroad in the interests of that company. The concerns represented by the new company are: J. A. Fay & Egan Co., Cincinnati, Ohio; the Onsrud Machine Works, Inc., Chicago, Ill.; Wilkin Challoner Co., Oshkosh, Wis.; Bell Machine Co., Oshkosh, Wis.; St. Joseph Iron Works, St. Joseph, Mich.; Sinker-Davis Co., Indianapolis, Ind.; Standard Dry Kiln Co., Indianapolis, Ind.; Ross Carrier Co., Benton Harbor, Mich.; and Covel-Hanchett Co., Big Rapids, Mich.

FRANK J. TONE, president of the Carborundum Co., Niagara Falls, N. Y., was awarded the honorary degree of Doctor

of Science by the University of Pittsburgh at the commencement exercises on June 5 "as an outstanding scientist, engineer, inventor, and executive."

MORSE CHAIN CO., Ithaca, N. Y., and the Detroit Division of the BORG-WARNER CORPORATION, at a recent meeting of the board of directors, elected the following

C. J. Kenerson, General Manager of the Morse Chain Co.

officers: President, D. B. PERRY; vice-president, general manager, and treasurer, C. J. KENERSON; secretary and assistant general manager, N. K. VAN OSDOL.

R. T. PIERSON has been elected vice-president and general manager of the USL Battery Corporation, Niagara Falls, N. Y., following the resignation of A. A. MACLEAN. Mr. Pierson was previously manager of the power battery division.

J. W. BARNETT, recently director of the division of construction and finance of the United States Shipping Board, has joined the marine department of the Babcock & Wilcox Co., 85 Liberty St., New York City.

REPUBLIC STEEL CORPORATION, Youngstown, Ohio, has moved its Buffalo district sales office from 475 Abbott Road to 1020 Liberty Bank Building. Thomas B. Davies continues in charge as district sales manager.

R. M. NEUMANN has been made manager of the pigment division of the New Jersey Zinc Sales Co., with headquarters at 160 Front St., New York City.

O. W. MCMULLAN has joined the research staff of the International Nickel Co., Inc., 67 Wall St., New York City. He will be located in the research laboratory maintained by the company at Bayonne, N. J. Mr. McMullan was formerly chief metallurgist at the Timken-Detroit Axle Co., Detroit, Mich.

ALBERT C. BRUCE, president of the United States Hoffman Machinery Corporation, has been elected a member of the board of directors of the Worthington Pump & Machinery Corporation, Harrison, N. J.

Ohio

KIRKBY MACHINERY & SUPPLY CO., 20-22 St. Clair St., Toledo, Ohio, has been added to the list of distributors of the products of the Diamond Chain & Mfg. Co., Indianapolis, Ind. Roller chain of various pitches, as well as sprockets and flexible couplings, will be carried in stock.

GLOBE TAPPING MACHINE CO., Bridgeport, Conn., announces that the tapping and drilling machines formerly made by that concern will be manufactured and sold in the future exclusively by the DRESES MACHINE TOOL CO., 3366 Beekman St, Cincinnati, Ohio.

DONALD LOYHED has just been appointed Cleveland representative of the Read Machinery Co., Inc., York, Pa., manufacturer of a line of mixers for the chemical and industrial trade. Mr. Loyhed will be located at 7500 Euclid Ave., Cleveland, Ohio.

J. N. BAUMAN, formerly assistant sales manager of the White Motor Co., Cleveland, Ohio, has been advanced to the position of general sales manager. He succeeds GEORGE F. RUSSELL, resigned.

WHITE MOTOR CO., Cleveland, Ohio, announces that export headquarters have been re-established at the home office in Cleveland under Robert L. Boughton, export manager.

Oklahoma

HARRY O. AMES, formerly with the Crane Co., Chicago, Ill., has joined the sales force of the Rawlplug Co., Inc., New York City, manufacturer of the Rawl line of anchoring devices. Mr Ames will have charge of the Oklahoma territory, and will be located at 1023 N.W. 12th St., Oklahoma City.

Pennsylvania

LOUIS ALLIS CO., Milwaukee, Wis., manufacturer of electric motors, has appointed the HARRIS-GREEN CO., 1101 Farmers Bank Bldg., Pittsburgh, Pa., engineering sales representative for the company in the western Pennsylvania territory.

E. A. CARPENTER has been elected secretary of E. F. Houghton & Co., 240 W. Somerset St., Philadelphia, Pa., manufacturers of oils and leathers, to fill the vacancy caused by the recent death of A. Everly Carpenter, III.

EDGCOMB STEEL CO., Philadelphia, Pa., has been appointed agent in the Philadelphia district for the complete line of steel products made by the Timken Steel & Tube Co., Canton, Ohio.

REVERE COPPER & BRASS, INC., announces the removal of its Pittsburgh office to 1028 Gulf Bldg., Pittsburgh, Pa.

COMING EVENTS

JULY 15-20—INTERNATIONAL CONGRESS FOR SCIENTIFIC MANAGEMENT in London, England. For further information, address Industrial Development Association, British Empire Bldg., 620 Fifth Ave., New York City.

AUGUST 19-23 — Convention of the AMERICAN FOUNDRYMEN'S ASSOCIATION at Toronto, Canada, with headquarters at Hotel Royal York. C. E. Hoyt, executive secretary-treasurer, 222 W. Adams St., Chicago, Ill.

SEPTEMBER 11-21—MACHINE TOOL EXPOSITION to be held in Cleveland, Ohio, under the auspices of the National Machine Tool Builders' Association, 1220 Guarantee Title Bldg., Cleveland, Ohio.

SEPTEMBER 18-20 — Convention of the NATIONAL INDUSTRIAL ADVERTISING ASSOCIATION at Pittsburgh, Pa.; headquarters, William Penn Hotel. Further information can be obtained by addressing W. J. Ramsey, Industrial Advertising Council, P. O. Box 1198, Pittsburgh, Pa.

SEPTEMBER 30 - OCTOBER 4 — NATIONAL METAL EXPOSITION AND CONGRESS under the auspices of the American Society for Metals to be held in the International Amphitheatre, 43rd and Halsted Sts., Chicago, Ill. W. H. Eisenman, secretary, American Society for Metals, 7016 Euclid Ave., Cleveland, Ohio.

NOVEMBER 18-20 — Twenty-second NATIONAL FOREIGN TRADE CONVENTION of the National Foreign Trade Council in Houston, Tex. Secretary, Lindsay Crawford, National Foreign Trade Council, 26 Beaver St., New York City.

NEW BOOKS AND PUBLICATIONS

ENGINEERING SHOP PRACTICE Vol. II. By Orlan William Boston. 485 pages, 6 by 9 inches. Published by John Wiley & Sons, 440 Fourth Ave., New York City. Price, $5, net.

This is the second volume of a work on engineering shop practice which was the outgrowth of a course presented to engineering students at the University of Michigan. The first volume treated basic processes, such as turning, shaping, planing, drilling, boring, reaming, threading, sawing, and milling. The present volume is devoted to production machines, in some of which the basic processes are combined, as in the hand-operated and automatic turret lathes. Technical information is given about materials of which parts are made, such as those made from bar stock in screw machines, sheet metal in punches and dies, products molded and die-cast in dies, and liquids used as cutting fluids. Manufacturing is correlated with design and metallurgical requirements. Although the book is intended primarily for use as a text, it has been made sufficiently complete to be useful to production and designing engineers, superintendents, foremen, and operators.

STANDARDS OF FOUR-YEAR FOUNDRY APPRENTICESHIP. 16 pages, 6 by 9 inches. Published jointly by the American Foundrymen's Association, 222 W. Adams St., Chicago, Ill., and the National Founders' Association, 29 S. LaSalle St., Chicago.

In view of the probable scarcity of skilled workers confronting industry, this pamphlet on apprenticeship standards should be of interest. It contains a report of the committees on apprentice training appointed by the associations mentioned. The standards adopted cover recommendations on selection, terms, schedules of advancement, related instruction, and terms of indenture. In addition, general suggestions are included on how to install an apprentice training course. The work of these committees will be followed by a special session on the subject at the Toronto convention of the American Foundrymen's Association in August. At this meeting, talks will be given by Victor Hydar, personnel manager of the Falk Corporation, Milwaukee, Wis., and J. E. Goss, employment manager of the Brown & Sharpe Mfg. Co., Providence, R. I.

THE SLIDE-RULE. By Charles N. Pickworth. 132 pages, 5 by 7 inches. Published by the D. Van Nostrand Co., 250 Fourth Ave., New York City. Price, $1.50.

This is the twentieth edition of a little handbook on the use of the slide-rule. It describes how to multiply, divide, obtain powers and roots, and perform other algebraical and trigonometrical processes with the slide-rule. In order to give the learner facility, many practical examples, such as an engineer may be called upon to solve, are included. All the new developments in slide-rules are recorded, one of which is the introduction of "differential" scales which provide an extended range of the trigonometrical scales, with a degree of accuracy more consistently high than is obtainable with the normal arrangement. This widens the application of the scales for scientific and commercial calculations.

IMPACT AND STATIC TENSILE PROPERTIES OF BOLTS. By Herbert L. Whittemore, George W. Nusbaum, and Edgar O. Seaquist. 50 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Research Paper No. RP763 of the National Bureau of Standards. Price, 10 cents.

INDUSTRIAL TRUCK AND TRAILER SOLID TIRES. 11 pages, 6 by 9 inches. Published by the United States Department of Commerce, Washington, D. C., as Simplified Practice Recommendation R103-33 of the National Bureau of Standards. Price, 5 cents.

NATURALLY ALLOYED PIG IRON, CAST IRON, AND STEEL CASTINGS. By S. S. Nekryty. 35 pages, 6 by 9 1/4 inches. Published by the Amtorg Trading Corporation, 261 Fifth Ave., New York City.

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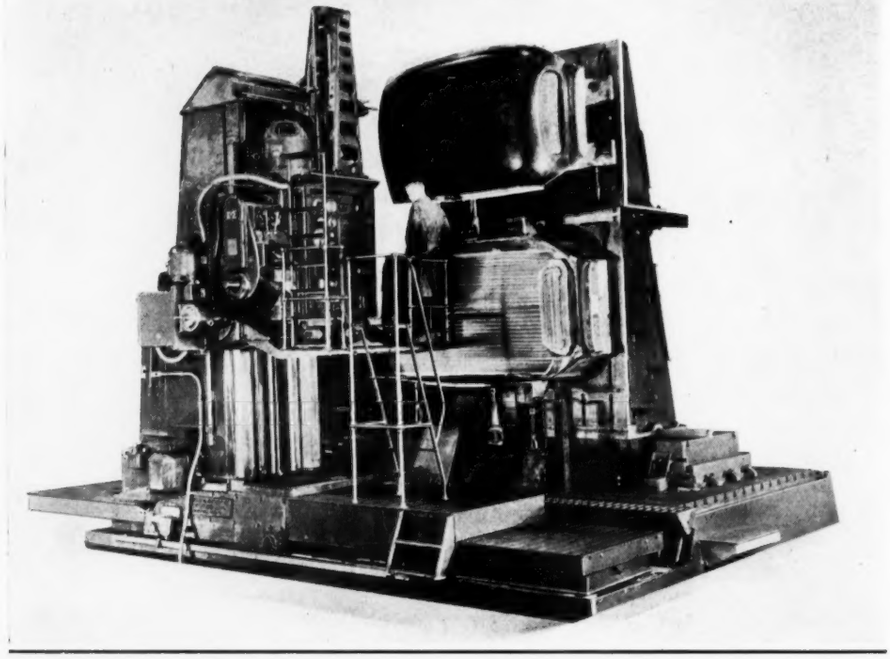

The huge dies that form the one-piece solid-steel turret tops for Fisher bodies on General Motors cars were milled to the required shape on a Keller automatic tool-room machine that is by far the largest to be built up to this time. This machine weighs 154,000 pounds—almost two and one-half times as much as its largest predecessor. It is over 21 feet high, 32 feet long and 19 feet wide. The machine is installed in one of the Fisher body plants.

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